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Trade, Foreign Exchange, and Energy Policies in the Islamic Republic of Iran

Reform Agenda, Economic Implications, and Impact on the Poor

Jesper Jensen
David Tarr

Reflecting the large initial distortions, trade, exchange rate, and energy reforms could generate large welfare gains for the Islamic Republic of Iran. If combined with direct income payments to all households (not just the poor), the poor would benefit enormously. The authors show that well intentioned policies of commodity subsidies for the poor can have perverse effects.

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Summary findings

The Islamic Republic of Iran has committed itself to substantial trade and market reform in its Third Five-Year Development Plan. It started out with nontariff barriers on all products, a dual exchange rate regime with the market rate more than four times the official rate, and domestic energy subsidies equal to about 90 percent of the cost of energy products. Many of these policies were justified as helping the poor.

To analyze the effect of the reforms, separately and together, Jensen and Tarr develop a multisector computable general equilibrium model with 10 rural and 10 urban households. They find that the combined reforms could generate welfare gains equal to about 50 percent of aggregate consumer income. These gains reflect the large initial distortions—for example, energy subsidies equal to about 18 percent of GDP, and retail energy prices equal to about 10 percent of world market prices. Separately, trade reform would lead to gains of about 5 percent of income, exchange rate reform to gains of 7 percent of income, and energy pricing reform to gains of 33 percent of income.

The authors' results show that well-intentioned commodity subsidy policies for the poor can have perverse effects. Direct income payments to all households (not just the poor) would vastly increase the incomes of the poor compared with the status quo. Moreover, if the combined reforms were implemented, the poorest rural household would receive gains equal to about 290 percent of its income, and the poorest urban household gains equal to about 140 percent of its income.

This paper—a product of Trade, Development Research Group—is part of a larger effort in the group to assess the impact of trade policy reform on the poor. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Paulina Flewitt, room MC3-333, telephone 202-473-2724, fax 202-522-1159, email address pflewitt@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at jj@copenhageneconomics.com or dtarr@worldbank.org. January 2002. (37 pages)

Trade, Foreign Exchange, and Energy Policies in the Islamic Republic of Iran:

Reform Agenda, Economic Implications, and Impact on the Poor

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Trade, Foreign Exchange, and Energy Policies in the Islamic Republic of Iran:

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I. Introduction

Iran has applied for membership in the World Trade Organization (WTO), and with the passage of the law for the Third Five Year Development Plan on April 5, 2000, the government of Iran has committed itself to the use of the market mechanism as a means of regulating foreign trade. Iran began this reform process, however, from a highly distorted trade and exchange rate regime. The principal distortions are: non-tariff barriers; the dual exchange rate system and highly subsidized petroleum product prices.[1] While applied tariffs were low, non-tariff barriers (in the form of import licenses) restrained imports of all goods. A dual exchange rate system prevailed in which the market rate was more than four times the official rate. Finally, petroleum product prices in Iran were only about ten percent of world market prices. Reforms are proposed or contemplated in all these areas, but the impact on the poor is a major issue in assessing whether the reforms can be implemented.

While tariffication of non-tariff barriers and lowering of tariffs are important steps in the Iranian effort to join the WTO, it is more important to assess the consequences of these actions on Iranian development and on the poor. In this paper, we present quantitative estimates of the impacts of reform of all of the principal distortions mentioned above. We develop a multi-sector computable general equilibrium model of the Iranian economy to provide the estimates. The model contains 20 households, 10 rural and 10 urban grouped according to income, so that in addition to results at the sector and macro level, the model produces estimates of the impact on the poor and on the distribution of income. The results for the poor households are crucial, given the importance Iranian policy-makers place on the impact of policy change on the poor.

More specifically, the policy changes we consider and the motivation for examining these are as follows:

Tariffication of non-tariff barriers

In Article 115 of the law for the Third Five Year Development Plan, the government indicates it plans to eliminate non-tariff barriers to foreign trade and substitute tariff barriers at their equivalent level.[2] Estimates of the tariff equivalence on non-tariff barriers are notoriously difficult to obtain. We, however, have been fortunate to obtain these estimates for virtually all major products in the economy. As a result, our estimates of the value to the economy of

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[1] For more details on the institutional background to the trade, exchange rate and energy sectors see World Bank (1999 and 2001).

[2] There is an intergovernmental committee led by the Ministry of Commerce that is responsible for tariffication of non-tariff barriers. It decides on the timing of products to be converted to tariff barriers and recommends the equivalent tariff level. Of the 5313 tariff lines in the Iranian code, almost 1900 tariff lines have had the non-tariff barriers removed by end 2000.

tariffication of non-tariff barriers is, to our knowledge, the first data based estimate for an economy that is replete with such barriers. Assuming rent dissipation of the non-tariff barriers (we also provide estimates without rent dissipation) , tariffication will lead to an increase in Iranian aggregate welfare of 3.4 percent of the value of consumption in the benchmark equilibrium.[3] We assume that the additional revenue received by the government is distributed back to households in equal absolute amounts. As a result, the poor gain substantially from this policy reform (the poorest rural household gains 23 percent of its income and the poorest urban household gains 11 percent). The reason is that the poor have such little income that the distributions from the government have a significant effect on their income.

Lowering Tariffs and Tariff Uniformity.

We next consider the impact of lowering tariffs to either a maximum 25 percent or to a uniform 15 percent. [4] Both policies result in a significant increase in welfare, but the poor gain much more from uniform tariffs since uniformity generates greater revenue for the government relative to simply reducing all tariffs above 25 percent to 25 percent.

Unification of the Exchange Rate for Import Purchases (with and without consumption subsidies).

Several Iranian government officials have indicated that it is the intention of the government to unify the exchange rate for imports during the period of the 3rd Five Year Development Plan. Certain imports qualify for foreign exchange at the official rate of 1750 Rials per US dollar, whereas the Tehran Stock Exchange (TSE) rate was about 8150 Rials per US dollar in November 2000. In effect, imports of these commodities are subsidized by the government through allocation of foreign exchange at the official exchange rate. These subsidies were equal to almost 7 percent of GDP in 2000.

We estimate that the elimination of the subsidies to foreign exchange will increase aggregate welfare by 6.9 percent of consumption. Despite the fact that some of the subsidies for purchases of imports are intended to assist the poor, it is the poor who will disproportionately gain from this policy.

Since the imported agricultural commodities are part of the government's program to help the poor, we also consider the policy of using consumption subsidies for essential commodities to replace foreign exchange subsidies to essential commodities. That is, when subsidized imports are eliminated (for all products not just essential commodities), the government at the same time is assumed to subsidize the consumption of essential commodities. This policy is efficiency enhancing compared with exchange rate subsidies, because exchange

[3] Welfare estimates are Hicksian equivalent variation reported as a percent of Iranian consumption (for aggregate welfare) or as a percent of household consumption in the case of individual households. Iranian consumption is about 37% of Iranian GDP in our dataset. Thus, the welfare gains as a percent of GDP, are about 37 hundreths of the numbers reported for welfare as a percent of consumption.

[4] This will also be an important step in the process of entering the WTO, since as a practical matter acceding countries in recent years have been required to have low to moderate tariff barriers in order to gain admission to the WTO.

rate subsidies discriminate against domestic production. Consumption subsidizes substantially raise the price to Iranian **producers** of essential commodities compared with the status quo of subsidizing imports only, without, by assumption, raising the price to consumers. The policy produces welfare gains of 6.7 percent of consumption. Since subsidizing particular products retains a distortion, the aggregate gains are lower than the policy of simply unifying the exchange rate without consumption subsidies. More interestingly, the welfare gains to the poor are much lower (72 percent versus 46 percent of the value of consumption is the gain).

Our results show that well-intentioned policies for the poor can have perverse effects, at least when compared to direct income payments. Even though the direct income payments we consider (equal absolute payments to all households) are not targeted at the poor in our scenarios, they do a better job of improving the welfare of the poor than commodity subsidies, even though the commodity subsidies are perceived to be aimed at the poor. The commodity subsidies create inefficiencies between sectors. More importantly, the commodity subsidies are not well targeted for the poor since the rich buy more of all commodities, including the subsidized commodities. In summary, we find that direct income payments, even if not well targeted initially, are much superior to commodity subsidies in assisting the poor. More targeted direct income payments would be even more efficient for the poor.

Energy Pricing Reform

Petroleum prices in Iran are only about 10 percent of world prices and we estimate that the petroleum product subsidies are 18 percent of GDP. If the fiscal surplus from the elimination of the petroleum product subsidies is transferred back to the households in equal amounts, the poorest rural (urban) household gains over 200 (100) percent of their income.

Combining Trade, Energy and Exchange Rate Reform

Finally, we estimate the impact of implementing **all** the trade, exchange rate and energy policy reforms in the pricing area that we have considered: tariffication, tariff reduction, exchange rate unification and energy pricing reform. The Iranian economy is estimated to experience and enormous gain of more than 50 percent of the value of consumption following the combined reforms. With zero tariffs the gains are 50.7 percent of consumption; with a uniform 15 percent tariff the aggregate welfare gains are slightly less at 50.1 percent of consumption. The poor gain slightly more from the uniform tariff at 15 percent since we assume the fiscal surplus is distributed to the poor and there is a greater fiscal surplus to distribute with the 15 uniform tariff.

The estimated gains in welfare that we find are extremely large by the standards of this type of model (constant returns to scale model). Constant returns to scale numerical modeling estimates of the impact of trade liberalization have often found that trade liberalization increases the welfare of a country by only about one-half to one percent of GDP.[5] The very large

[5]Examples of constant returns to scale models with estimates of welfare gains from trade liberalization of less than one percent of GDP include: de Melo and Tarr (1990; 1992; 1993); Harrison, Rutherford and Tarr (1993; 1997a; 1997b); Morkre and Tarr (1980; 1995); and Tarr and Morkre (1984). Imperfect competition and product variety, however, can result in much larger estimated gains (Rutherford and Tarr, forthcoming).

estimated welfare gains reflect the unusually high level of distortions present at the starting point of the reform in Iran. The combined fiscal impact of all the reforms (with a 15 percent uniform tariff) is estimated to be an increase in the fiscal surplus by 18.5 percent of GDP.

The fiscal surplus generated by the reforms presents great opportunities for Iran to help the poor with direct income support payments. These payments are potentially vastly more efficient in terms of help to the poor than commodity subsidies, and there should be sufficient revenue generated, that the real incomes of the poor (after adjusting for higher prices of commodities) could be significantly improved. The fiscal surplus will also permit investment where appropriate such as institutional development to assist private sector development.

The paper is organized as follows. In section 2 we describe the key data on the tariffs, non-tariff barriers and subsidies that are fundamental to the results of the model. In section 3, we briefly describe the model and other aspects of the data. In section 4 we present and interpret the results of the policy scenarios. This includes individual policy reforms an combinations of policy reforms. We provide conclusions in section 5 and an elaboration of the construction of the database in the appendix.

II. Data on the tariffs, non-tariff barriers and subsidies

In the section we explain how we obtained data on the key distortions to the trade and exchange rate regime. It is well known that these data are fundamental to the results of the analysis. We explain the data on the energy subsidies in the appendix.

Data regarding tariff rates in the initial year

Imports into Iran are subject to both an import duty and the commercial benefit tax (CBT).[6] What would normally be referred to as the tariff on imports is the sum of these two items. Actual collected tariffs, however, in Iran are quite low by international standards. Based on customs department data for collected tariffs in fiscal year 1998/99, aggregate collected tariffs were 0.3 percent of GDP. Collected tariff rates are rather low for two reasons: (1) for the purposes of customs valuation, all imports are valued at the official exchange rate. This amounts to 78 percent reduction in assessed import duties relative to the market exchange rate as of November 2000; and (2) the principal means of import protection has been non-tariff barriers exercised through licensing requirements.[7]

For the sectors in our model, we present the average collected duty and CBT in table 1. These data were calculated as follows. Since up to date applied tariff data are important, we obtained the collected tariff data at the tariff line level for fiscal year 1999/2000. Iran employs the International Harmonized System at the 6-digit level, which contains 5313 tariff lines.[8]

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[6] There are also some small fees the most notable of which is the registration fee at the Ministry of Commerce. These fees, however, are collectively still quite small relative to the import duty and the CBT.

[7] In addition there are some exemptions from the payment of import taxes such as duty drawback.

[8] Iran intends to disaggregate some of the tariff lines, introducing tariff lines at the eight or possibly ten digit level to reflect national needs.

These tariff lines were aggregated with simple averages to obtain the average collected tariff at the level the sectors in our model. Since it is what the importer pays that affects the decision to purchase, collected tariff rates should be superior to legal tariff rates. Thus, we updated the data in the input-output table for our model with collected tariff rates for 1999/2000.

Tariff equivalence of the non-tariff barriers (NTBs)

Tariffication Plans and Progress. With the passage of the Third Five Year Development Plan, Iran has committed itself to tariffication of the NTBs. In previous years, an import license was required for goods that could be legally imported. That is, there was a "Positive List" of goods that were not banned. If the good were on the Positive List it could be legally imported, but it still required a license from the responsible industry, typically the Ministry of Industry, Ministry of Agriculture or Ministry of Mines.

The commitment to tariffy the NTBs has manifested itself in several ways. First, the Positive List is rapidly expanding. In fiscal year 1998/99 the Positive List consisted of 29 broad categories of products. This was expanded to 41 broad product categories in early 2000 and 77 broad product categories by November 2000. It is expected that the Positive List will include all products except for those banned for religious or health and safety reasons.

Second, the requirement to obtain a license by the relevant line Ministry is being eliminated. Only the registration requirement at the Ministry of Commerce (which is accomplished routinely within a few days) will remain for virtually all goods when the tariffication process is complete.[9] As of November 2000, line Ministry licensing had been eliminated for 1900 tariff lines out of the 5313 tariff lines in the Iranian system. In addition, the decision had been taken by the government to eliminate line Ministry licensing for an additional 895 tariff lines categories. Finally, during the transition, if the item is on the Positive List it is reported that even for those products which still require line Ministry licensing, the line Ministries are providing the license more rapidly than in the past.

Estimated tariff equivalence of the NTBs. The intergovernmental committee chaired by the Ministry of Commerce, which includes the Ministry of Industry, is responsible for recommending the tariff equivalent of the NTBs. International versus domestic price comparisons are being done based on a database of prices. The database contains 70 million observations from Iranian customs declarations. The Ministry of Industry has been responsible for providing the licenses for approximately 3000 of the tariff lines in the manufacturing sectors and it has estimated the tariff equivalence of the NTBs for the 3000 tariff lines for which it is responsible. We have obtained estimates from the Ministry of Industry of Iran of the new commercial benefit tax necessary to provide tariff equivalence of the NTBs and have supplemented that information with the following consideration. For imports that are subsidized in the initial period, we take the tariff equivalence to be zero.[10] For imports that are not on the

[9] Provided licenses are routinely issued within ten working days of application for the import license, licensing is not considered a non-tariff barrier under WTO rules.

[10] Several sectors in our model are combinations of sub-sectors. Sometimes, one sub-sector may receive import subsidies, while another sub-sector receives no import subsidies, but is protected by licenses. In these cases, we report the tariff equivalence of the non-tariff barrier as the tariff equivalent rate which applies on the protected sub-sector times its share of the overall sector.

Positive List, the tariff equivalence of the NTB should be very high, since it can't legally be imported. For products on the Positive List, we assume the tariff equivalence is lower than for those products that are not on the Positive List.

We are able to calculate the tariff equivalence of the NTBs from the data we have as follows. Define:

PM = the domestic price of imports in Rials
PW = the border price of imports in dollars
ER = the market exchange rate (Tehran Stock Exchange rate), Rials per dollar
TD = the customs duty
CBT(0) = the commercial benefit tax prior to tariffication
CBT(1) = the commercial benefit tax after tariffication
NTB = the tariff equivalent of the non-tariff barrier in ad valorem terms.

Prior to tariffication, there is a NTB in place. Although we do not have data directly on the tariff equivalent of the non-tariff barrier (NTB), it is defined by the following equation:

$$PM = PW*ER[1+TD+CBT(0)][1+NTB].$$

After tariffication, the NTB is removed and replaced by a higher CBT. We have:

$$PM = PW*ER[1+TD+CBT(1)].$$

As mentioned, we have obtained estimates of CBT(1) from the Ministry of Industry and other considerations. Since the increase in the CBT is supposed to leave the domestic price of imports unchanged, we have:

$$PM = PW*ER[1+TD+CBT(0)][1+NTB] = PW*ER[1+TD+CBT(1)]$$

or

$$[1+TD+CBT(0)][1+NTB] = [1+TD+CBT(1)].$$

Rearranging, the tariff equivalent of the NTB is:

$$NTB = [1+TD+CBT(1)]/[1+TD+CBT(0)] - 1$$

We have data on all of the right hand side variables. Thus, we may calculate the left hand side which is the tariff equivalent of the non-tariff barrier. These estimates are presented in table 1.The NTB rate for a sector typically represents the average tariff equivalent in a product category, since each category represents many tariff lines. These estimates are based on the Tehran Stock Exchange (TSE) exchange rate, i.e., they are about 20% of the tariff equivalents that would prevail if imports were valued at the official exchange rate. It is the intention of Iran to convert to customs valuation at the TSE rate, but more importantly, we need rates that reflect real costs that induce resource movement, so we must use the TSE rate for the tariff equivalents of the NTBs.

Distribution of the Rents from the NTBs. A key question in assessing the consequences of tariffication of the NTBs is what happens to the quota rents when the NTBs are in place. We model this is two ways: one is which all the rents are dissipated through rent seeking, and the second where the rents are distributed lump sum to the owners of the firms who obtain the licenses, with no rent dissipation. We believe the appropriate result is between these two extremes, with the true state closer to rent dissipation. We take rent dissipation as our central assumption unless otherwise indicated.

Rent dissipation follows from the conventional theory of rent seeking. The model of Barzel (1973), for example, maintains that resources are expended to obtain the licenses, and that competition among license seekers results in costs that dissipate the rents available. The classic example is queuing for a good under price control. In this case the queue lengthens until the value of the time in the queue is just equal to the difference between the market price and the controlled price of the good. In the case of licenses for imports there are lobbying costs, queuing costs and inefficiencies in the cost of the delivery of final products where the imported good is an intermediate. Given that the license to import has value, competition among license seekers will dissipate the rents. Since the value of the license to import is the difference between the domestic price and the **tariff inclusive** world price, competition for rents would not dissipate the tariff revenue. Thus, the difference between the domestic and world price of quota constrained products is part tariff and part rent, where the rent is competed away in higher costs for the rent seekers. Elimination of the NTB through tariffication would eliminate the rent from obtaining the license to import and eliminate the wasteful expenditure of resources on rent seeking behavior. Thus, this view of license allocation implies there are real resource gains for conversion to the tariff equivalents of NTBs and welfare should increase significantly for all households. In addition, the poor are likely to gain, since we shall assume that the tariff revenue of the government will be distributed to all households in equal amounts.

No rent dissipation would occur if recipients of the licenses to import are unable to influence the decision on who gets the licenses. That is, the size of the firm or any payments or lobbying of officials is irrelevant regarding the receipt of the license. When a firm receives the license to import, it receives a windfall profit equal to the difference between the domestic price of the imported product and the tariff inclusive import price, i.e., it receives the tariff equivalent of the quota. We assume this value accrues to the owners of the factors of production in the firm. This value ultimately is part of household income, since the owners of the factors of production are the households. When we impose tariffs and eliminate the NTBs counterfacturally, under this assumption of no rent dissipation, the tariff revenue of the government increases, and the government distributes the tariff revenue back to the households in an equal lump sum manner. Although this will be little or no efficiency or aggregate welfare effect from this process, the will be significant distribution of income effects. In particular, the poor will be better off and the rich worse off under our distribution mechanism. This is, because the rents from the quotas accrued to the owners of the factors of production in the economy (of which the poor hold a small share), whereas the tariff revenue is distributed to the households in equal shares.

Data regarding centrally allocated foreign exchange

In fiscal year 1999/2000 the official rate for a US dollar was 1750 Rials and the market rate was approximately 8150 Rials per US dollar. In general, exporters receive the market exchange rate for their exports and importers who do not receive centrally allocated foreign exchange pay the market exchange rate. Consequently, the principal impact of the dual exchange rate is to provide a subsidy to those who receive centrally allocated foreign exchange for imports. Since centrally allocated dollars at the official exchange rate cost only about 21 percent of dollars from the market, those who received centrally allocated dollars received a subsidy of about 79 percent of the market value of the dollars. At the same time producers in these sectors are disprotected (or are facing an effective negative tariff) by 79 percent.

We wish to determine the impacts of unifying the exchange rate for current account purposes. Unification will have resource allocation and efficiency effects because it removes the subsidy to foreign exchange for imports of certain products and for imports for specified purposes.

Imported goods qualifying for foreign exchange at the official exchange rate fall into one of the following categories: essential food commodities, pharmaceuticals and petroleum products, investment demand for state owned enterprises and national defense.[11]

Essential food commodities comprise wheat, rice, sugar, cooking oil and milk powder. The Government Trading Corporation imports these products. They fall into three sectors in of our model: farming, sugar and other food products. Imports of these commodities collectively represent 10 percent of the value of imports at the official exchange rate. The Ministry of Health imports pharmaceuticals, which is about one percent of the value of imports. The Iranian National Oil Company imports petroleum products, comprising an additional 8 percent of the value of imports.

Our measure of the subsidy to the sector is adjusted proportionately based on the share of the sector's imports that is subsidized. In the case of sugar and pharmaceuticals, all imports receive the subsidy, so the subsidy is listed at 79 percent. Farming and other food products have the subsidy reduced in proportion to the share of imports in the sector that receive the subsidy. [12]

Regarding the investment projects of the State Owned Enterprises, one of the largest categories of imports in our IO table is "industrial machinery." We assume that 75 percent of these imports are destined for the investment demand of the State Owned Enterprises at the official exchange rate. The subsidy rate is thus estimated at 59 percent (75 percent of 79 percent).

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[11] Debt repayment (both central government and individual enterprise) also qualifies for foreign exchange at the official exchange rate.

[12] We employed Customs Department mimeo data to calculate the share of imports in the farming and food products categories that are comprised of subsidized commodities. For customs valuation purposes, all imports are valued at the official exchange rate. The government intends to value all imports at the rate of exchange from the Tehran Stock Exchange.

Based on data from the Central Bank of Iran, fifty percent of imported goods in fiscal year 1999/2000 were imported at the official exchange rate. The sum of the above categories above represents 32 percent of the value of imports based on the data in the input-output table.

In addition to the above imports, which are for the purpose of private consumption or intermediate use in industry, the central government allocates foreign exchange for the national defense. We take national defense as the residual 18 percent of centrally allocated foreign exchange at the official exchange rate. We assume that national defense is the central government's own final consumption. That is, the central government holds foreign exchange that is uses to purchase imported goods for its own consumption in the form of national defense expenditures. As a result the rate at which the foreign exchange is accounted for national defense purposes is irrelevant for economic decision-making, and we ignore national defense expenditures in the analysis that follows.

Energy Subsidies

Direct energy subsidies apply on four of the seven energy products in our model: gasoline, kerosene, gas oil and fuel oil. Since the subsidies are on consumption of the products, they apply on imports as well as domestic consumption. (Iran imports small amounts of these products.) We obtained data from the Iranian Ministry of Oil on the domestic consumption price of the four energy products and the world price at the comparable period. Since we take world prices as exogenous to Iran, we calculate the subsidy rates as between 74% and 94%.

Table 0: Estimated domestic and international prices for petroleum products, 1999/2000

	Domestic prices (Rials/liter)	International Prices* (Rials/liter)	Ratio (%)	Subsidy rate
Gasoline	350.0	1329.2	26.3%	73.7%
Kerosene	100.0	1254.3	8.0%	92.0%
Gas oil	100.0	1136.9	8.8%	91.2%
Fuel oil	50.0	880.6	5.7%	94.3%

*Note: International prices are converted to Rials at the market exchange rate on the Tehran Stock Exchange of 8150 Rials per dollar.

Source: Iranian Ministry of Oil and authors' calculations

III. The Model

Our Small Open Economy (SOE) model is designed for trade policy analysis with a large number of sectors. The model is a generic constant returns to scale general equilibrium model of a single small open economy. Explanation of the equations for this type of model may be found in de Melo and Tarr [1992, chapter 3]. We describe here the general features of the model here, but refer the reader to de Melo and Tarr for a mathematical treatment. Given its importance in the Iranian economy, energy plays a more central role in our model than in de Melo and Tarr. We characterize the structure of production for the energy and non-energy sectors in figures 1-3.

Consumer demand is depicted in figure 4. The principal departure from the model of de Melo and Tarr is the treatment of multiple households.

Table 1 lists the 43 production sectors in the model. Goods are produced using primary factors and intermediate inputs. Primary factors include labor and capital. In addition, land is a factor of production that is specific to the production of agriculture. Labor and capital are perfectly mobile which yields a unique real wage rate and rental rate on capital for the entire economy. Goods used as intermediates are an "Armington" composite of domestic and imported goods. The world prices of imported and exported goods are fixed, i.e., the small open economy assumption which implies the absence of any terms of trade effects. Production exhibits constant returns to scale and individual firms behave competitively, selecting output levels such that marginal cost at those output levels equals the given market price. From Euler's theorem, payments to primary factors exhaust value added. Output in all sectors except for crude oil is differentiated between goods destined for the domestic and export markets. This relationship is characterized by a constant elasticity of transformation (CET) frontier. Composite output is an aggregate of domestic output and exports. The structure of production and allocation of output for the non-energy sectors are depicted in figure 1 (with elasticities).

Regarding the crude oil sector, we continue to employ the assumption of constant returns to scale, Armington aggregates for intermediates, cost minimization and marginal cost pricing. The sector differs from other sectors in that production of oil requires the use of a sector-specific primary factor, i.e., natural resources (oil). We assume that the government owns this primary factor and consequently the government receives the returns from this primary factor. Capital and labor are mobile factors among all sectors and receive the unique wage rate and return on capital. Given that natural resources is a specific factor of production owned by the government and constant returns to scale prevail, the royalties or rents to the government vary residually such that zero profits prevail. This structure results in the government, in effect, being the residual claimant to the revenues from the sale of produced oil after the payment of intermediate goods, wages, and rent on capital to produce oil. This appears appropriate in view of the fact that the revenues from the Iranian National Oil Company are reported as part of the government's budget, unlike the treatment of other state owned enterprises. We report any changes in oil rents as part of changes in government revenue from policy changes.

We assume that crude oil output is a homogeneous product with no distinction between Iranian crude oil and the crude oil on the world market. The structure of production and allocation of output for oil are depicted in figure 2. This structure follows Bernstein, Montgomery, Rutherford and Yang (1999).

Given its importance in the Iranian economy, we have seven sectors in the model that produce refined energy products: gasoline, kerosene, fuel oil, gas oil, liquid gas, natural gas, and electricity. The first four of these are the sectors where consumption is heavily subsidized directly (the estimates were listed above). Although the structure of production is somewhat different for energy sectors compared with non-energy sectors (see figure 3), the assumptions of constant returns to scale, Armington aggregates for intermediates, cost minimization, marginal cost pricing and zero profit equilibrium continue to apply in these sectors. We also continue to

apply the CET assumption for sectors where there are exports initially.[13] The principal distinctions for these sectors are the modeling of energy inputs and, crucially, energy subsidies.

Regarding the modeling of energy inputs in refined energy production, we assume zero substitution both between energy inputs and, most importantly, between energy inputs and other inputs. This reflects that there is a roughly fixed physical relationship between, for example, the amounts of crude oil required to produce a given amount of gasoline.

Regarding the energy subsidies, we assume that consumers pay an artificially low and controlled price for energy products (shown in the table above) and that the government pays the difference, i.e., a subsidy, such that demand is met at the controlled price. Sellers of energy receive the payment by consumers plus the subsidy, and domestic producers optimize their output decisions between domestic sales and exports according to a CET. Since the price paid by domestic consumers remains fixed, if the domestic market for energy does not clear, the government will alter the subsidy rate. Thus, the subsidy rate is endogenous to policy changes, and we report in the results the amount by which petroleum product subsidies changes in each scenario. We illustrate this government intervention in figure 5, where for simplicity, and contrary to our model, we assume that exports and domestic products are homogeneous.

There are 20 household types in the model, 10 urban and 10 rural, all grouped according to income. The 10 rural household types contain 38% of the Iranian population with an equal number of households in each group (i.e., 3.8%). Similarly, each urban household type contains 6.2% of Iranian households. Our estimates are that the poorest two urban and poorest two rural households are below the one dollar a day poverty line. The shares of each consumer's expenditure on different commodities differ. Based on the household expenditure survey we present the budget shares of households in table 2, where we have aggregated commodities into energy, food, transportation and other commodities. The "other" category increases with income. Although we have the source of income by factor of production for households in aggregate, we do not have data for the factor income source at the level of the individual household. Consequently, we assume that all households obtain their income from the different factors of production in identical proportions.[14] The structure of demand is depicted in figure 4.

Government demand for goods and services and investment demand are exogenous. Government revenue derives from rents on crude oil, import tariff revenues and exogenous lump-sum taxes. Government expenditures finance the exogenous government demand for goods and services, plus subsidies to foreign exchange for imports, subsidies to petroleum products and (in one counterfactual) food subsidies.

We impose an "equal yield constraint" on government revenue, i.e., any loss (gain) of government revenue must be offset by a lump sum tax (subsidy). In all of our scenarios, the

[13] There are no exports of liquid gas, gasoline, kerosene, gas oil, electricity, construction and postal services in the initial equilibrium. Thus, the requirements for the CET assumption are not satisfied, and we assume that the output of these four sectors can not be exported.

[14] The trade and exchange rate reforms tend to favor the farming, sugar and weaving and leather products sectors. These sectors should intensively use unskilled labor, the key source of income for the poorest households. This might allow us to predict that the poor would be expected to do no worse than we have estimated from these reforms.

government is reducing subsidies, which reduce government expenditures. In all scenarios we hold the government demand for goods unchanged (otherwise welfare analysis would be meaningless, since only consumers obtain utility and only from private goods). Consequently, when government revenues are increased, they are endogenously distributed back to households so that the government demands are unchanged. Thus, government demand is balanced with revenue (which is consistent with the loose requirement in Iran to balance the budget). We, however, calculate and present the impact of all policy changes on the revenues of the government, and policymakers in practice may consider alternate expenditures for these revenues such as institution building to assist the development of the private sector.

The decision rule we typically adopt is that lump sum distributions of the government are given to households in equal shares. That is, suppose the government is distributing 10,000 Rials. Since rural households in aggregate constitute 32% of all households, it will provide 320 Rials to each of the 10 rural household types. It will provide 680 Rials to each of the 10 urban household types, which collectively represent 68% of all households. This implies that all individual households, rural and urban, receive the same Rial amount.

We suggest this decision rule for distributions for several reasons. First, although less efficient as a safety net for the poor than lump sum distributions targeted at the poor, more targeted distributions have the difficulty that it may be administratively difficult to identify who are the poor. Some of the poor, who can ill afford a period of lowered income, may be excluded inadvertently. Second, on political economy grounds, if all households receive distributions, there is likely to be less opposition to the reforms. Third, if all households receive distributions, then there is no disincentive to work as a result of the distribution scheme, i.e., no income level at which additional earnings result in ineligibility for distributions and a net reduction in after distribution income.

Criticism of our distribution scheme has taken two forms. First, some argue that distributions to the rich are politically unacceptable. We note, however, that all Iranians are recipients of government commodity subsidies and the wealthy receive larger subsidies than the poor since subsidies are in proportion to consumption. For example, the per capita benefits of fuel subsidies to members of the richest urban quintile were 6.7 times the per capita benefits to those in the poorest urban quintile. For the rural quintiles the corresponding ratio was 5.5 (World Bank, 1999). Thus, compared to commodity subsidies, our distribution rule will be a progressive distribution scheme since the poorest households receive less than an equal share of most commodity subsidies (even the subsidies targeted for the poor) because they consume less of virtually all goods.

Second, some have suggested that the distribution scheme is not feasible—that it is not possible to set up a system to monitor who has received a distribution and that the system will be plagued by fraud. But we note that Iran has a photo identification system in place for the distribution of ration coupons for edible oils, sugar and cheese that has been in place since the time of the Iran-Iraq war. Bearers present their ID to a bank and receive the coupons. This system could be expanded to cover cash distributions. The likelihood of fraud would increase if substantial amounts of cash were involved, but fraud would require complicity of the bank teller.

Additional study to assess how fraud could be reduced is appropriate, but fraud is prevalent in any safety net distribution system.

Since private consumption equals the income from primary factors plus net transfers by the households to the government (from domestic and foreign trade taxes), Walras law is satisfied.

World market import and export prices are fixed, so there are no endogenous changes in the terms of trade. In other words, import supplies and export demands are infinitely elastic at given world prices. The real exchange rate in the model adjusts such that the current account balances the value of exports and imports taking into account exogenously fixed capital inflows. Our model allows for changes in these fixed world prices, such as a change in the price of crude oil on world markets.[15]

The appendix contains more details on the model structure and the construction of the underlying database.

IV. Policy Results

Results of the main policy simulations are presented in table 3. In the first column of table 3, we present summary data regarding the fiscal situation in the initial equilibrium of the model. Import taxes and foreign exchange subsidies have been discussed above. Petroleum subsidies are due to the energy policy of providing petroleum products at a given domestic price. These subsidies vary with the cost of foreign exchange since some of these products are imported. Oil rent is the revenue that accrues to the government from the sale of oil after payments to labor and capital to produce the oil. Revenues or subsidies from each of these sources can change in any scenario due to a direct change in the policy related to the tax or subsidy or to an indirect effect when another variable is changed. The latter can have "second best" effects as we will discuss below. The fiscal effects are reported as a percent change from the benchmark equilibrium (where we consider that the rents from import licensing are dissipated).

Tariffication of Non-Tariff Barriers

As discussed in the data section above, the impact of the tariffication of NTBs depends on whether the rents from the existing NTBs are dissipated through rent seeking. We do two simulations: one in which all the rents are lost to rent seeking behavior and the other in which no rents are lost. We believe the actual situation is closer to rent dissipation and employ rent dissipation as our central assumption.

Dissipation of the Rents from the NTBs. In column (1) of table 3 we present results of the scenario we call Tariffification. In this scenario rents from the NTBs are dissipated in the benchmark equilibrium. Tariffication then has the effect of increasing aggregate welfare by 3.4

[15] The OPEC quota on oil exports is typically not binding on Iran.

percent of initial household income. Although all households gain from this scenario, the positive impact on the welfare of the poor households is dramatic: the poorest rural household gains 23 percent and the poorest urban household gains 11 percent. The reason for this favorable distribution effect on the poor is that as a result of converting NTBs to tariffs, the collected tariffs of the government increase by 2 percent (to 2.3 percent of GDP). On the other hand, government revenues are endogenously affected by the depreciation of the real exchange rate. The output and income expansion induces an increase in the demand for imports. The real exchange rate must depreciate to restore equilibrium in the balance of trade. The depreciated exchange rate implies that the cost of the government subsides to foreign exchange and to imported petroleum products increases, worsening the government's fiscal position. On the positive side, the revenues the government receives (after factor payments) from the sale of oil on world markets increases with exchange rate depreciation by 0.5 percent of GDP. On balance the fiscal impact of the government is positive 1.4 percent. As discussed above, it is necessary to adopt a decision rule for what the government does with the additional revenue from the reforms (or how it obtains revenue if there is a loss in revenue). Unless otherwise specified, we assume that these additional revenues are distributed back to households in equal absolute amounts per household (obviously, alternate expenditures are possible with the additional government revenues). Since the poor have such low incomes, the distribution of these revenues represents a significant share of their income.

An interesting and **unique** aspect of this scenario is that the output of all Iranian industries expands. This is because the rent seeking behavior consumed real resources, labor and capital. Tariffication freed these resources from wasteful activity to produce output. At the same time, the increase in the supply of labor and capital for production results in a fall in the real wage of 0.1 percent and a fall in the rental rate on capital of 0.4 percent. The impact on incomes is more than offset by the additional output available from productive use of the newly available capital and labor and the income transfers from the government.

Tariffication of NTBs without Rent Dissipation. The results of this scenario are presented in column 2 of table 3. The principle impact of the tariffication of NTBs without rent dissipation is the increase in government revenues. Again the government revenues increase by 2.0 percent of GDP, and again the increase in government revenue is distributed back to households in equal Iranian Rial amounts. As a result the poor households gain substantially, even though the rich households lose in this scenario. The distributional impacts are strictly progressive because we had assumed in this scenario that the rents from the quotas were not dissipated. Rather they accrued to the households in proportion to their income. Thus, tariffication without rent dissipation implies that the households lose the rents from the quotas in proportion to their income.

The aggregate welfare impact of this scenario is slightly negative for two reasons. First, tariffication without rent dissipation results in the same set of international prices and no improved resource allocation regarding the international trade regime. But, tariffication results in a negative second best effect due to the increased consumption of food and energy products. Given the change in the distribution of income, expenditure in the economy shifts toward the budget items consumed more intensely by the poorer households. As shown in table 2, the poor intensively consume food, energy and transportation (and transportation is an intense direct user

of energy subsidies). The increased demand for food and energy results in a slight reduction in economy-wide efficiency and welfare because these products are excessively consumed in the initial equilibrium due to the subsidies.

On the other hand, the poorest household actually gains more in this scenario. The reason is that while the rents from the licenses are distributed to households in proportion to their income, the poor receive a disproportionately large share of the transfers relative to their incomes. The government budget expands by a larger amount without rent dissipation because the lower output expansion induces a much smaller the real exchange rate depreciation. This in turn implies a smaller increase in the cost of petroleum product subsidies (even though the quantity of petroleum products consumed domestically increases).

The impact of the different policy changes on domestic output, prices and exports at the sector level is presented in tables 5.4 and 5.6.

Unification of the Exchange Rate

We evaluate the impact of unifying the exchange rate for the purpose of imports and exports. More specifically, we simulate the removal of subsidies through centrally allocated foreign exchange at the official exchange rate for essential commodities (wheat, rice, sugar, cooking oil, milk powder and pharmaceuticals), and for the investment demands of state owned enterprises. Petroleum product consumption subsidies are considered part of energy policy so we retain them except in the energy policy scenarios.

The objective of the subsidized foreign exchange for essential commodities is to assist the poor. Consequently, we consider alternate safety net programs to assist the poor if these subsidies are removed. We consider two alternate programs that might be designed to address the needs of the poor when the subsidies to essential commodities and other foreign exchange subsidies are removed: equal lump sum distributions; and consumption subsidies to keep the price of essential commodities unchanged to consumers. We illustrate the welfare economics and impact on government revenues of the two mechanisms in figure 6.

Equal Lump Sum Distributions to All Households. First, when we eliminate the foreign exchange subsidies, we consider the impact of distributing the additional revenue the government obtains from the elimination of the subsidies back to all households in an equal lump sum payment to each household. This is our basic distribution mechanism. The results are presented in table 3, column 5. The reason all households are included is that it may be difficult to identify at first which households are the poor. Over time, it may become possible to accurately identify the rich and poor households, at which time the safety net payments can be targeted more precisely.[16] But so that no needy household is excluded, some would argue that such a broad payment approach is initially required.

[16] This was the process employed in Jordan in the 1990s, where food subsidies were converted initially to a payment to all households, but became targeted to only the poor over several years. Iran has in place an identification card system which could be used as a basis for providing the subsidies.

The aggregate welfare gain from this policy is a very large 6.9 percent increase as a percent of income, and corresponds in figure 6 to the gains from elimination of both the production and consumption deadweight loss. This shows how very inefficient a dual exchange rate regime can be when the exchange rate subsidies are as large as four or five to one.

The prices of the essential commodities increase significantly, 11 percent for farm products, 6 percent for food and 38 percent for sugar. Despite these price increases, what is really striking is the enormous increase in the welfare of the poorest households. The poorest two rural households (both earn less than one dollar per day) experience an increase in their welfare of 72 and 45 percent. The poorest urban households gain 32 and 20 percent. These households are so poor that the lump sum distribution payments represent a substantial portion of their income. Note that all individual households gain from this policy but that this distribution scheme is monotonically progressive: the poorer the household, the larger the percentage gain. Thus, even though the distribution scheme is not perfectly targeted at the poor, it is a highly pro-poor distribution scheme.

There is a significant positive output response of the farming sector of 13 percent as a result of an increase in the price of domestic farm products by 7 percent. The import subsidies represent an implicit tax on the farming sector which have to compete with heavily subsidized imports. Removing subsidies to imports, results in an increase in the price of farm products and removes the implicit tax on Iranian farmers. Their output expands as a result. Similarly, the other domestic producing sectors that competed with subsidized imports (sugar, food product producers of oils, pharmaceuticals and industrial machinery) see demand for their products increase and they respond with increased production in the new equilibrium. These sectors expand considerably and compete resources away from the other sectors. The elimination of subsidies to imports reduces the demand for foreign exchange so there is a strong appreciation of the real exchange rate by an estimated 13 percent. Output effects by sector are also partly explained by the appreciation.

Subsidies to the Consumption of Essential Commodities, Equal Lump Sum Taxes. With the elimination of subsidized foreign exchange for imports, an alternate scheme for the protection of the poor that is sometimes proposed is subsidized consumption of the essential commodities. That is, in this scenario, instead of subsidizing imports, there is a subsidy to consumption of the essential commodities: pharmaceuticals, sugar, farm products and other food products. The results are presented in tables 3 and 3A, column 6. This subsidy does not discriminate according to the geographic source of the imports. This removes the implicit tax on domestic producers of the import competing product from subsidies to imports. Figure 6 illustrates the situation, where the consumption deadweight loss is retained, but the gains are due to the elimination of the production deadweight loss.

We observe a very substantial aggregate welfare gain from this policy equal to 6.7 percent of income. Since subsidies to consumption of essential food commodities and pharmaceuticals distort resource allocation toward production and consumption of these commodities, the aggregate welfare gain is less than the policy of exchange rate unification without subsidies to consumption (6.9 percent). But, quantitatively, the production distortions of import subsidies are much more important the consumption distortions.

There is no change in the price of any of the essential commodities by design of the experiment.[17] Since all subsidies to foreign exchange are eliminated in this scenario (not only those to essential commodities) the net fiscal impact to the government is positive.[18] Then the poor households gain in this scenario, but considerably less than with elimination of foreign exchange subsidies **without** subsidies to food consumption. The lower gains to poor households are explained by the fact that there are less fiscal gains to be distributed back to households due to the subsidies to food consumption. The model helps us to understand that this potential policy designed to help the poor can be counterproductive to their interests.

Lowering tariffs and introducing competition

The government intends to introduce foreign competition in the Iranian marketplace subsequent to tariffication of non-tariff barriers. Since the government intends to follow a gradual approach to tariff liberalization, we simulate a possible sequential process of lowering tariffs in two steps. In the first step, we lower all tariffs above 25 percent to 25 percent, leaving all other tariffs unchanged. In the second step, we impose a uniform tariff of 15 percent. Unless otherwise indicated, all simulations are performed based on a benchmark equilibrium in which rent dissipation is assumed. The simulation we perform combines the effect of tariffication of NTBs and lowering tariffs in some sectors. That is, we eliminate the NTBs and tariffy them, but alter the tariff rate relative to the tariff equivalent based on the tariff assumption we make in the scenario. For example, the clothing tariff is less than full tariffication in the maximum 25 percent scenario. We infer the marginal impact of lowering the tariffs as the difference between the scenario that combines the effect of removing NTBs **and** lowering tariffs with the scenario in which we only do tariffication.of NTBs. (We use the term tariff to refer to the combined import duty plus commercial benefit tax.)

Maximum 25 Percent Tariffs. First consider the simulation in which all sectors with tariffs above 25 percent have their tariffs lowered to 25 percent along with tariffication of NTBs in other sectors. The results are presented in table 3, column 3. Aggregate welfare increases relative to the initial equilibrium by 4.1 percent of real consumer income. The average effective or collected tariff is initially 2.5 percent and increases to 19.4 percent. When the maximum tariff is 25 percent the average effective tariff is reduced to 15.3 percent.

Regarding the marginal effect of lowering the tariffs, given tariffication of NTBs, we observe that the marginal impact of lowering the high tariffs to 25 percent maximum is 0.6 percent of real consumer income. By the standards of welfare results for trade liberalization this is a rather large gain in welfare for a change in the average tariff rate of this magnitude. It illustrates once again that biggest gains in a trade policy reform are derived from lowering protection to moderate levels in the sectors with the very high protection.

[17] Results in table 3A on prices are for the price received by producers. The price paid by consumers is less than this due to the subsidy to consumers.

[18] On the other hand, there is a net fiscal cost to the government from consumption subsidies for a particular product relative to an import subsidy.

As shown in table 1, the sectors with highest tariffs after tariffication are: textiles (74), clothing (93), weaving and leather products (75), and motor vehicles (37). These tariffs, and those in glass and other food products, are lowered to 25 percent, with other tariffs unchanged. The reduction in protection results in a deprecation of the real exchange rate by 2.5 percent, which induces an increase in exports by 4.5 percent. Three of the four sectors with the highest protection are the ones that contract, while the other sectors expand. When the combined effects of tariffication and maximum 25 percent tariffs are considered, the negative impact on these sectors is muted, but still negative.

The weaving and leather products sector is interesting since we estimate it will expand despite the lowering of nominal protection. This is for two reasons: (1) the depreciation of the real exchange rate helps the exports of this sector along with all other export sectors and (2) imported textile products decline in price significantly and 30 percent of the intermediate inputs used by this sector are textiles.

Uniform 15 Percent Tariffs. The impact of tariffication and moving all tariffs to 15 percent is presented in table 3, column 4.[19] Combining elimination of NTBs with tariff uniformity at 15 percent results in an increase in aggregate welfare relative to the initial equilibrium by 5.5 percent of real consumer income, where the impact of removing the NTBs with rent dissipation is included. The marginal impact of imposing uniform tariffs is 2.0 percent. The impact on output by sector is similar to the 25 percent maximum tariff scenario.

Impact on the Poor. The combined effect of tariffication and lowering tariff protection has a strong positive impact on the income of the poorest households. Fifteen percent uniform tariffs and elimination of the NTBs results in a 20 percent increase in the income of the poorest rural household and an 11 percent increase in the income of the poorest urban household. All households gain, but the percentage increase in income declines monotonically with income since the equal lump sum transfers by government of the fiscal surplus represents a higher percentage of income for the poorer households.

The **marginal impact** of lowering tariff protection given tariffication has a negative revenue impact on the government. The adverse fiscal impact is greater with the 25 percent maximum tariff scenario (0.7 decline in revenue) than with the 15 percent uniform tariff (0.4 percent decline in revenue). This is because with tariff uniformity the low tariffs are raised to 15 percent, which increases revenue, partly offsetting the revenue loss for the lowering of the tariffs above 15 percent. Since the impact on the poor is primarily a function of the lump sum transfers, and if the fiscal effect is negative we assume a lump sum transfer from households to the government, the marginal impact on the poor of lowering tariff protection given prior tariffication is negative. The **combined** impact of the trade reforms contemplated by the government in the Third Five Year Development Plan are positive on the poor, provided the poor receive as transfers their share of the fiscal surplus that is generated.

[19] Tariffs are a uniform 15 percent in this scenario except for petroleum products. We assume that the tariffs on petroleum products are part of energy policy that we separately analyze.

Energy

As we discussed in the model section, petroleum prices are sold domestically at prices about only 10 percent of world prices. In this scenario we remove the enormous subsidies to energy products. The results are presented in table 4, column 3. Eliminating the subsidy to domestic consumption of petroleum products results in an enormous increase in welfare of 33 percent of consumption. The large gains are partly the result of starting with such a large distortion: petroleum subsidies are initially 18 percent of GDP. If the fiscal surplus from the elimination of the petroleum product subsidies is transferred back to the households in equal amounts, the poorest rural (urban) household gains over 200 (100) percent of income.

The elimination of the energy product subsidies results in a large decline in the domestic demand for crude oil production. Given homogenous domestic and exports crude oil products, crude oil exports expand dramatically by 76 percent. Resulting in a significant appreciation of the real exchange rate by 26 percent. Consequently, there is a Dutch disease problem regarding exports of the rest of the economy, who see their exports decline.[20]

Several energy intensive manufacturing sectors suffer significant output declines (between 25 and 63 percent) in this scenario. This includes basic metals and steel; other materials and chemicals; copper, aluminum and other basic products; motor vehicles; radio and TV equipment; and other industrial products. Farming, food products and several services sectors experience significant expansion. Output declines of this magnitude are likely to result in significant adjustment costs to relocate and retrain workers; we do not estimate these adjustment costs.[21] It is also likely, however, that over time the energy intensive sectors will adjust by becoming more efficient in the use of energy, a possibility that is not permitted in our model except through the substitution of capital and labor. The latter effect would imply less output adjustment than we have estimated, and less implied adjustment costs.

Combining Trade and Exchange Rate Reform

In these scenarios we combine the effects of tariffication of NTBs, unification of the exchange rate for imports and exports, and lowering tariffs. We consider two tariff policies: a uniform tariff at 15 percent and zero tariffs. The results are in tables 4 and 4A, columns 1 and 2. The welfare gain from combining these policies is 12.3 percent of the consumption with 15 percent uniform tariffs and 12.7 percent with zero tariffs. The poor gain enormously from these combined policies but the poor gain more from the 15 percent uniform tariff because there is less fiscal surplus to distribute to the poor if tariffs are zero. The impact on production is dominated by the sectors that benefit from the elimination of the foreign exchange subsidies.

[20] Even fuel oil exports decline since the real exchange appreciation of 26 percent, results in a larger decline in the domestic price of exports than in the price of domestic fuel oil products.

[21] Estimates of adjustment costs have found that adjustment costs are typically very small in relation to the benefits of trade liberalization. See Matusz and Tarr (2000).

Combining Energy and Exchange Rate Reform

As shown in table 4, column 4, combining exchange rate reform with energy reform increases the aggregate welfare gain to 39 percent of benchmark consumption. Since both energy and exchange rate reform increase revenues to the government, there is a potential enormous increase in welfare to the poor if the fiscal surplus is distributed back lump sum to households. The poorest rural household gains 239 percent and the poorest urban household gains 116 percent. All households gain, but the percentage gains decrease with the income level of the household.

Combining Trade, Energy and Exchange Rate Reform

Finally, in table 4, columns 5 and 6, we present estimates of the gains from combining all the key policy reforms in the pricing area that we have considered. We consider two options regarding the ultimate tariff policy: uniform 15 percent tariff (column 5) and free trade (column 6). The estimates are that the Iranian economy would experience and enormous gain of more than 50 percent of the value of consumption following the combined reforms. Aggregate gains from the combined policies with the zero tariff option are 50.7 percent of consumption. If tariffs are a uniform 15 percent then the aggregate welfare gains are slightly less at 50.1 percent of consumption. Again, the poor gain slightly more from the uniform tariff at 15 percent since we assume the fiscal surplus is distributed to the poor and there is a greater fiscal surplus to distribute with the 15 uniform tariff.

V. Conclusion

Iran plans to transform to a market based economy and many of the needed reforms are embodied in the 3rd Five Year Development Plan. We have obtained an unusually rich set of data on the distortions that prevailed in the year 2000. These distortions were very large. Petroleum product subsidies were 18 percent of GDP. Subsidies to foreign exchange were over 6 percent of GDP and non-tariff barriers were estimated to average about 17 percent of the value of imports.

The estimated gains in welfare that we find are extremely large by the standards of these types of constant returns to scale comparative static model. The very large estimated welfare gains reflect the unusually high level of distortions present at the starting point of the reform.

Iran has implemented many of its policies through subsidies and non-tariff barriers. The fiscal impact of all these reforms will be strongly positive. The combined fiscal impact of all the reforms (with a 15 percent uniform tariff) is estimated to be an increase by 18.5 of GDP. This fiscal surplus generated by the reforms presents great opportunities for Iran to help the poor with direct income payments. We find that despite the fact that many of the policy interventions are rationalized as support for the poor, direct income payments, even if not targeted to the poor, have the potential to enormously increase the income of the poor compared with the market interventions that prevail.

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Table 1. Production sectors in the model and the policy instruments
(Data are the percentage rates of the distortions)

		Import Duty	Commercial Benefit Tax (pre-reform)	Non-Tariff Barrier (tariff equivalent)	Commercial Benefit Tax (post tariffication of NTBs)	Energy subsidy to consump-tion	Foreign exchange subsidy for imports
1	Farming	0.1	0.7	9.2	10.0		63.0
2	Livestock	0.1	0.7	19.1	20.0		
3	Other agriculture	0.1	0.7	14.2	15.0		
4	Mining	0.5	1.1	13.7	15.0		
5	Crude oil						
6	Sugar						79.0
7	Other food	0.1	0.4	29.5	30.0		31.0
8	Paper & print	0.7	2.4	6.4	9.0		
9	Cement	1.1	1.0	19.6	21.0		
10	Brick	1.1	8.2	11.7	21.0		
11	Gypsum & other minerals	0.7	2.3	18.2	21.0		
12	Glass	1.3	6.5	21.8	30.0		
13	Other non-metal products	1.1	5.3	14.8	21.0		
14	Textiles	0.4	2.3	69.8	74.0		
15	Clothing	3.1	11.1	69.1	90.0		
16	Weaving & leather products	0.6	3.6	67.6	74.0		
17	Rubber & plastic products	0.4	1.3	23.3	25.0		
18	Pharmaceutical products						79.0
19	Kerosene		0.1		0.1	92.0	
20	Fuel oil		0.1		0.1	94.0	
21	Gasoline		0.1		0.1	74.0	
22	Gas oil		0.1		0.1	91.0	
23	Liquid gas		0.1		0.1		
24	Other materials & chemical products	0.3	1.7	7.2	9.0		
25	Basic metal & steel products	0.4	3.1	16.3	20.0		
26	Copper & aluminum & other basic products	0.4	3.1	16.3	20.0		
27	Metal products	1.0	4.9	4.8	10.0		
28	Industrial machinery	0.6	2.1	7.7	10.0		59.0
29	Radio & TV equipment	1.2	2.8	16.5	20.0		
30	Motor vehicles	1.4	2.1	32.8	36.0		
31	Other industrial products	0.5	2.9	16.5	20.0		
32	Electricity						
33	Water						
34	Natural gas						
35	Construction						
36	Trade						
37	Restaurants						
38	Hotel & motels						
39	Load transport						
40	Passenger transport						
41	Post & telecommunications						
42	Other transport & storage						
43	Other services						

Source: Iranian Ministry of Industry, Iranian Ministry of Oil, and authors' estimates as explained in the text.

Table 2. Expenditure shares by household type (in percent)

Households	Energy	Transportation	Food	Other	Total
Rural 1	4	23	44	29	100
Rural 2	4	15	49	33	100
Rural 3	3	22	44	31	100
Rural 4	3	15	47	35	100
Rural 5	3	19	43	35	100
Rural 6	3	16	39	42	100
Rural 7	3	20	41	37	100
Rural 8	3	12	43	41	100
Rural 9	3	14	37	47	100
Rural 10	1	6	14	79	100
Urban 1	2	11	35	52	100
Urban 2	3	9	34	54	100
Urban 3	2	13	29	55	100
Urban 4	2	12	29	56	100
Urban 5	2	10	27	60	100
Urban 6	2	10	28	60	100
Urban 7	2	11	26	61	100
Urban 8	2	9	22	67	100
Urban 9	2	8	17	73	100
Urban 10	1	5	10	83	100

Note: Rural household 1 is a representative household representing the poorest 10 percent of Iranian rural households. Rural household 10 represents the richest 10 percent of Iranian rural households. Each rural household contains 3.2% of all Iranian households. Urban households are defined analogously where each urban household represents 6.8% of all Iranian households.

Source: Authors' aggregations of expenditure categories based on the 1999/2000 Iranian Household Expenditure Survey.

Table 3. Impact of Trade and Exchange Rate Reforms

	Initial situation (level values)	Tarrification	Tariffication without rent dissipation	Tariffication & maximum 25% tariff	Tariffication & Uniform 15% tariff	Exchange Rate Unification	Exchange Rate Unification & Food Subsidies
		(1)	(2)	(3)	(4)	(5)	(6)
1. **Aggregate welfare change** (% of income)		3.4	-0.4	4.1	5.5	6.9	6.7
2. **Fiscal effects** (change as % of GDP)							
Food subsidies							-2.1
Foreign exchange subsidies	-6.4	-0.3	-0.1	-0.8	-0.2	6.4	6.4
Petroleum subsidies	-18.1	-0.8	-0.1	-1.7	-1.9	2.7	2.3
Import taxes	0.3	2.0	2.0	1.7	1.6	0.0	0.0
Oil rent	15.7	0.5	0.1	1.4	1.5	-3.8	-3.7
Net effect		1.4	1.9	0.7	1.0	5.3	2.9
3. **Average effective tariff rate** (%)	2.5	19.4	19.5	15.3	13.9	2.8	2.8
4. **Trade effects** (% change)							
Real exchange rate		1.1	0.2	3.6	3.8	-13.0	-12.2
Aggregate Exports		1.0	0.1	5.6	4.9	-21.9	-22.4
5. **Factor incomes** (% change)							
Wage rate		-0.1	0.1	0.2	0.4	3.0	6.8
Return to capital		-0.4	-0.2	1.1	1.4	-4.7	-1.7
6. **Price of essential goods** (% change)							
Primary food items		1.2	0.3	1.6	2.5	10.5	
Food products		0.6	0.2	0.8	0.4	6.0	
Sugar		0.0	0.0	0.6	7.4	37.6	
Pharmaceuticals		-0.3	-0.1	0.8	2.3	1.0	
7. **Change in household welfare** (% of income)							
Rural 1		23.3	27.9	15.6	20.2	72.0	46.3
Rural 2		15.2	16.6	10.9	14.2	44.6	30.5
Rural 3		10.8	10.4	8.3	10.9	30.4	21.8
Rural 4		9.8	8.9	7.9	10.4	26.6	19.7
Rural 5		8.0	6.3	6.9	9.0	20.9	16.1
Rural 6		6.3	3.9	6.0	7.9	15.6	12.7
Rural 7		5.6	2.9	5.6	7.4	13.0	11.3
Rural 8		5.2	2.4	5.7	7.5	11.7	10.7
Rural 9		3.6	0.1	4.7	6.2	6.7	7.3
Rural 10		1.1	-3.8	2.6	3.6	-0.4	1.9
Urban 1		11.1	10.6	8.3	10.9	32.0	21.9
Urban 2		7.5	5.6	6.3	8.3	19.9	14.9
Urban 3		5.9	3.2	5.4	7.1	14.8	11.6
Urban 4		5.0	2.0	5.0	6.7	11.9	9.9
Urban 5		4.4	1.1	4.7	6.2	9.9	8.6
Urban 6		3.9	0.5	4.4	5.9	8.4	7.8
Urban 7		3.3	-0.4	4.1	5.5	6.5	6.5
Urban 8		2.6	-1.6	3.7	4.9	4.0	4.9
Urban 9		1.8	-2.7	3.1	4.2	1.9	3.4
Urban 10		0.9	-4.1	2.4	3.5	-0.7	1.5

Source: Authors' estimates.

Table 3a. Impact of Trade and Exchange Rate Reforms on Domestic Output, Prices, and Exports by Sector (percentage change from initial equilibrium)

	Tariffication with rent dissipation			*Tariffication without rent dissipation*			*Tariffication + maximum 25% tariff*			*Tariffication + uniform 15% tariff*			*Exchange rate unification*			*Exchange rate unification + food subsidies*		
	(1)			*(2)*			*(3)*			*(4)*			*(5)*			*(6)*		
Sector	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*
Farming	2.9	1.2	3.1	0.6	0.3	0.3	3.0	1.9	12.4	3.6	2.6	12.0	13.0	7.3	-42.7	15.8	7.9	-38.4
Livestock	3.1	1.7	2.1	0.8	0.4	0.2	2.6	2.2	11.2	1.9	2.2	11.2	4.0	5.7	-44.8	6.3	2.4	-33.8
Other agriculture	3.5	-0.2	8.2	0.7	-0.0	1.5	2.8	0.8	16.0	2.6	1.8	13.5	-3.5	3.2	-45.0	-2.9	0.7	-36.4
Mining	3.5	-0.3	8.6	0.5	-0.1	1.4	6.9	0.8	20.5	5.0	1.1	18.4	-14.4	-1.7	-43.6	-14.8	1.3	-45.1
Crude oil	0.9	1.3	-2.5	0.2	0.2	-0.2	1.9	4.9	-1.2	1.9	5.3	-2.1	-5.7	-14.4	-13.3	-6.2	-12.5	-14.8
Sugar	3.1	0.0	7.0	1.0	0.0	1.7	1.3	1.1	13.4	20.8	2.1	32.5	159.1	3.7	45.4	172.8	-0.3	84.3
Other food	3.3	0.7	5.3	0.7	0.2	0.9	2.8	1.4	14.1	1.3	1.7	12.1	5.4	4.1	-41.5	7.8	0.5	-28.9
Paper and print	3.6	-0.1	8.2	0.5	-0.0	1.3	3.6	0.9	16.6	4.9	1.5	16.9	-6.9	-1.6	-38.7	-6.9	-0.0	-37.7
Cement	0.9	-0.1	5.4	0.1	-0.0	0.8	1.9	0.5	16.0	0.7	0.5	15.8	-4.7	-1.4	-37.7	-4.8	1.1	-38.4
Brick	1.4	-0.2	6.2	0.0	-0.0	0.9	1.6	0.6	15.4	0.8	0.6	15.4	-2.6	-1.6	-35.9	-2.8	1.1	-37.1
Gypsum and other minerals	1.6	-0.3	6.5	0.1	-0.1	1.0	2.5	0.7	15.9	1.3	0.8	15.4	-4.4	-2.8	-34.9	-4.7	-0.2	-35.9
Glass	2.9	-0.2	7.7	0.2	-0.1	1.0	1.9	0.8	15.2	-0.8	0.8	12.8	-2.3	-2.6	-33.8	-2.9	0.0	-35.0
Other nonmetal products	0.8	-0.2	5.4	-0.0	-0.0	0.8	1.2	0.7	14.7	1.0	0.6	15.7	-1.2	-2.6	-33.0	-1.4	-0.2	-33.7
Textiles	3.5	0.0	7.7	0.1	-0.0	0.8	-8.2	0.1	5.7	-12.3	0.3	1.3	-9.6	-1.9	-39.9	-9.8	-0.3	-39.1
Clothing	3.1	-0.1	7.6	-0.2	-0.0	0.6	-14.6	-0.5	0.3	-18.3	-0.8	-2.5	-2.8	-1.8	-35.6	-3.9	0.7	-36.9
Weaving and leather products	6.9	-0.2	11.7	0.7	-0.0	1.5	13.8	-0.3	32.6	13.3	-0.3	33.2	-21.9	-2.0	-48.1	-21.8	-0.2	-47.4
Rubber and plastic products	4.3	-0.0	8.6	0.3	-0.0	1.1	5.5	1.3	17.3	0.7	2.5	9.2	-7.0	-4.3	-33.6	-7.5	-2.0	-34.2
Pharmaceuticals	2.0	-0.3	6.9	0.3	-0.1	1.3	1.7	0.9	14.3	5.7	1.4	18.2	18.3	-3.1	-18.5	18.0	-0.9	-19.0
Kerosene	3.4	1.3	0.0	1.0	0.2	0.0	3.4	4.8	0.0	4.0	5.1	0.0	5.3	-14.1	0.0	4.6	-12.2	0.0
Fuel oil	6.2	0.9	8.5	0.7	0.2	1.0	10.4	3.9	17.4	12.1	4.2	19.3	-16.5	-10.9	-34.3	-15.7	-8.7	-34.9
Gasoline	2.4	1.1	0.0	0.1	0.2	0.0	3.1	4.4	0.0	3.8	4.7	0.0	0.1	-12.8	0.0	0.9	-10.8	0.0
Gas oil	3.0	1.3	0.0	0.4	0.2	0.0	3.4	4.8	0.0	4.0	5.1	0.0	0.1	-14.0	0.0	0.5	-12.1	0.0
Liquid gas	4.1	0.3	0.0	1.5	0.1	0.0	3.6	2.0	0.0	4.2	2.3	0.0	9.1	-5.4	0.0	7.5	-2.8	0.0
Other materials and chemical products	8.1	0.0	12.4	1.3	-0.0	2.0	15.3	1.3	28.3	20.5	2.5	30.6	-28.7	-3.7	-49.9	-28.7	-1.7	-49.8
Basic metal and steel products	3.7	-0.1	8.2	0.5	-0.0	1.3	5.9	0.9	19.4	0.3	0.3	16.1	-12.6	-3.6	-38.9	-13.2	-1.3	-39.7
Copper, aluminum, and other basic products	4.3	-0.2	9.1	0.5	-0.0	1.4	8.5	0.6	23.3	4.8	0.7	19.8	-21.7	-1.1	-49.3	-21.4	0.5	-48.3
Metal products	1.4	-0.1	5.8	0.1	-0.0	0.9	3.5	0.8	16.9	5.4	0.3	21.8	-7.7	-3.1	-36.4	-7.8	-0.9	-36.5
Industrial machinery	0.1	0.0	4.0	-0.1	0.0	0.5	0.4	0.1	15.8	14.4	-1.1	38.0	434.4	-2.7	263.5	428.9	0.0	253.5
Radio and TV equipment	3.7	0.3	7.0	0.4	0.1	0.9	8.5	1.5	19.9	2.1	0.1	18.8	-18.0	-5.3	-39.5	-19.5	-2.7	-41.5
Motor vehicles	3.0	-0.1	7.5	0.0	-0.0	0.8	-5.4	0.7	7.1	-14.8	0.4	-1.7	-11.6	-3.7	-37.9	-12.0	-1.2	-39.0
Other industrial products	2.3	0.2	5.9	0.3	0.0	0.9	5.4	1.7	16.0	0.9	0.6	15.4	-13.9	-5.5	-36.1	-14.7	-2.9	-37.7
Electricity	3.2	-0.3	0.0	-0.1	-0.0	0.0	3.1	0.4	0.0	2.8	0.6	0.0	0.2	-0.7	0.0	-0.4	2.6	0.0
Water	3.5	-0.1	7.9	0.1	0.1	0.7	4.0	0.1	19.8	4.6	0.1	21.4	3.9	0.7	-36.3	3.9	3.7	-37.7
Natural gas	6.7	-0.0	11.0	1.0	-0.0	1.8	12.9	1.2	26.0	13.0	1.4	26.2	-14.7	-3.3	-40.8	-15.7	-1.0	-41.9
Construction	0.3	-0.2	0.0	-0.0	-0.0	0.0	0.3	0.7	0.0	0.3	0.6	0.0	0.1	-2.5	0.0	0.1	-0.1	0.0
Trade	2.6	-0.3	7.8	-1.7	-0.1	-0.7	2.7	0.9	15.4	2.8	1.2	15.6	-1.7	-3.0	-32.4	-1.2	-0.4	-33.1
Restaurants	3.2	0.3	6.5	-0.2	0.1	0.4	3.6	1.0	16.2	6.1	1.0	20.0	-5.6	1.9	-44.0	-2.9	-0.2	-34.7
Hotel and motels	3.8	0.1	7.6	-1.5	0.0	-0.9	8.2	0.8	21.9	17.3	0.9	33.1	-17.1	0.8	-49.3	-12.9	0.4	-42.5
Load transport	4.6	-0.3	9.7	1.0	-0.1	2.0	4.9	0.8	18.4	6.2	0.9	20.6	2.7	-3.0	-29.5	0.9	-0.5	-31.5
Passenger transport	3.6	-0.2	8.5	0.5	-0.1	1.4	3.1	0.9	16.2	5.1	1.1	18.7	1.6	-2.6	-31.0	0.4	0.0	-32.9
Post and telecommunications	2.7	-0.1	0.0	-1.2	0.0	0.0	2.5	0.3	0.0	2.9	0.4	0.0	1.5	0.4	0.0	0.8	3.5	0.0
Transport and storage	3.3	-0.2	8.0	-0.2	-0.0	0.6	3.8	0.4	18.5	3.9	0.5	19.4	-1.1	-1.0	-36.1	-0.7	1.7	-36.8
Other services	1.8	-0.2	6.5	-0.0	-0.0	0.8	1.7	0.6	15.5	2.4	0.7	17.1	2.7	-1.7	-32.2	2.0	0.6	-33.0

Source: Authors' estimates.

Table 4. Impact of Combining Trade, Exchange Rate and Energy Pricing Reforms

	Initial situation (level values)	Tariffication + exchange rate unification + uniform 15% tariffs	Tariffication + exchange rate unification + zero tariffs	Energy pricing reform	Energy pricing reform + exchange rate unification	Energy pricing reform + tariffication + exchange rate unification + tariff reform	
		(1)	(2)	(3)	(4)	(5)	(6)
						15% uniform tariffs	Zero tariffs
1. **Aggregate welfare change** (% of income)		14.0	12.7	32.9	38.8	50.1	50.7
2. **Fiscal effects** (change as % of GDP)							
Food subsidies							
Foreign exchange subsidies	-6.4	6.4	6.4	2.1	6.4	6.4	6.4
Petroleum subsidies	-18.1	0.8	-0.3	18.1	18.1	18.1	18.1
Import taxes	0.3	1.6	-0.3	0.1	0.1	2.1	-0.3
Oil rent	15.7	-2.2	-0.6	-7.0	-9.2	-8.1	-6.6
Net effect		6.6	5.1	13.3	15.3	18.5	17.6
3. **Average effective tariff rate** (%)	2.5	14.0		2.7	2.9	14.7	
4. **Trade effects** (% change)							
Real exchange rate		-8.5	-3.5	-26.1	-35.5	-31.9	-26.1
Aggregate Exports		-17.2	-8.9	30.4	16.6	25.8	35.3
5. **Factor incomes** (% change)							
Wage rate		3.1	3.2	2.4	7.7	8.4	7.8
Return to capital		-3.7	-1.3	-6.1	-7.1	-5.8	-3.7
6. **Price of essential goods** (% change)							
Primary food items		13.5	13.1	8.2	19.4	24.9	23.9
Food products		7.4	6.9	4.3	8.1	10.3	9.5
Sugar		40.9	41.9	-0.3	36.4	41.6	42.1
Pharmaceuticals		2.1	3.1	-4.0	-1.2	0.4	1.4
7. **Change in household welfare** (% of income)							
Rural 1		95.6	77.7	209.8	239.1	292.2	282.9
Rural 2		60.8	50.5	139.0	157.2	193.3	188.7
Rural 3		42.5	36.1	98.5	112.8	140.2	137.4
Rural 4		38.1	32.9	90.0	102.4	128.1	126.2
Rural 5		30.7	27.1	73.1	84.0	105.9	104.7
Rural 6		24.0	21.9	58.7	67.8	86.3	85.8
Rural 7		20.8	19.5	51.6	60.0	77.1	77.2
Rural 8		19.6	18.7	49.5	56.8	73.6	74.2
Rural 9		12.9	13.4	34.6	40.6	53.9	55.0
Rural 10		2.8	5.2	11.9	15.6	21.6	23.2
Urban 1		44.3	37.3	102.6	116.3	143.1	139.5
Urban 2		28.9	25.4	70.3	79.8	99.4	97.9
Urban 3		22.4	20.3	55.1	63.5	80.0	79.2
Urban 4		18.9	17.7	47.5	54.9	69.8	69.6
Urban 5		16.3	15.8	41.8	48.4	62.0	62.2
Urban 6		14.4	14.3	37.8	43.9	56.5	56.9
Urban 7		12.0	12.5	32.1	37.7	49.2	49.9
Urban 8		8.8	10.0	25.1	29.9	39.6	40.7
Urban 9		5.7	7.5	18.4	22.6	30.3	31.5
Urban 10		2.3	5.0	10.5	13.9	19.4	21.1

Source: Authors' estimates.

Table 4a. Impact of Trade, Exchange Rate, and Energy Pricing Reforms on Domestic Output, Prices, and Exports by Sector (percentage change from initial equilibrium)

	Tariffication + exchange rate unification + uniform 15% tariffs			*Tariffication + exchange rate unification + zero tariffs*			*Energy pricing reform*			*Energy pricing reform + exchange rate unification*			*Energy pricing reform + tariffication + exchange rate unification + uniform 15% tariffs*			*Energy pricing reform + tariffication + exchange rate unification + zero tariffs*		
	(1)			*(2)*			*(3)*			*(4)*			*(5)*			*(6)*		
Sector	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*	*Output*	*Prices*	*Exports*
Farming	17.3	10.2	-33.2	16.6	10.2	-19.3	12.0	7.3	-62.8	23.3	16.0	-77.8	29.8	21.2	-74.5	28.1	20.4	-66.8
Livestock	6.7	8 6	-36.4	5.2	8.4	-23.7	15.6	8.8	-63.2	14.5	13.4	-77.9	18.5	18.2	-74.9	16.6	17.4	-67.4
Other agriculture	-0.2	4.3	-32.9	-3.9	5.6	-24.6	3.0	-2.0	-55.0	-2.7	3.3	-75.1	2.5	5 0	-69.0	-0.8	6.0	-62.3
Mining	-9.0	-0.8	-28.9	-13.1	0.4	-20.5	-29.3	-2.7	-68.5	-37.8	-2.4	-81.1	-33.3	-1.4	-75.7	-37.1	-0.4	-71.2
Crude oil	-2.8	-8.6	-12.8	-0.7	-2.6	-7.6	-12.9	-25.7	76.2	-19.8	-34.5	61.3	-16.2	-29.5	72.3	-12.4	-23.2	82 9
Sugar	175.6	5.3	80.0	169.0	6.5	105.8	22.4	-0.7	-48.7	180.7	4.9	-31.5	210.0	7 3	-12.2	202.9	8.1	8.5
Other food	8.7	6.1	-30.5	7.0	6.3	-17.7	18.3	3.8	-56.5	16.7	8.2	-74.1	21.2	11.4	-69.3	18.9	11.3	-60.9
Paper and print	-0.6	-0.2	-23.6	-6.6	0.1	-13.8	-9.1	-3.5	-58.4	-17.6	-3.7	-74.1	-8.6	-1.8	-66.2	-13.8	-1.6	-59.0
Cement	-3.8	-1.0	-24 3	-5.6	-0.7	-10.9	-10.8	3.7	-67.1	-15.2	1.8	-77.4	-13.8	1.4	-71.1	-16.1	1.7	-63.9
Brick	-1.8	-1.1	-22.4	-3.3	-0.4	-9.5	-10.6	21.8	-79.7	-13.8	19.6	-85.8	-12.7	20.3	-82.5	-15.6	21.9	-78.9
Gypsum and other minerals	-2.9	-2.2	-20.8	-5.2	-1.1	-9 4	-10.5	3.7	-67.0	-14.2	-0.0	-75.8	-11.7	-1.0	-68.2	-14.5	0.1	-61.4
Glass	-3.1	-1.9	-21 6	-7.7	-1.1	-11.8	-5.1	-1.9	-58.7	-9.6	-2.9	-72.2	-10.3	-2.2	-66.5	-15 0	-1.4	-59.8
Other no-metal products	-0.2	-2.1	-18.9	-0.7	-1.7	-3.4	-1.2	-2.5	-56.2	-2.6	-3 9	-69.1	-1.1	-3 2	-61.8	-2.0	-2.8	-51 7
Textiles	-25.6	-1.9	-39.9	-27.5	-1.9	-29.0	-9.5	-3 0	-59.3	-16.4	-3.3	-74.0	-37.4	-3.3	-75.8	-40.4	-3 3	-70.1
Clothing	-23 7	-3.0	-36.2	-27.9	-3.0	-26.9	5.0	-2.6	-53.3	-0.7	-2.8	-69 5	-27.3	-4.3	-70.9	-31.0	-4.4	-64.2
Weaving and leather products	-20.6	-2.5	-34 7	-10.9	-2.3	-11.6	-24.5	-2.5	-66.5	-30.3	-3.3	-78 3	-36 7	-4 1	-74.9	-35.2	-3.9	-66 9
Rubber and plastic products	-6.4	-1.7	-24.9	-9.7	-2.6	-9.6	-12.2	-5.8	-56.8	-17.1	-8.7	-69.4	-16.3	-5.6	-65.2	-20.1	-6.1	-56 3
Pharmaceuticals	21.6	-2.0	-1 4	21.3	-1.0	15.5	13.8	-4.6	-46.1	30.5	-5.2	-56.8	36.3	-3.8	-46.5	35.9	-2.8	-33.1
Kerosene	9.6	-8.4	0.0	8.9	-2.5	0.0	-88.2	-24.7	0.0	-90.1	-33.3	0.0	-93.0	-28.4	0.0	-93.8	-22.3	0.0
Fuel oil	-6.9	-6.4	-19.2	-6.2	-1.6	-11 4	-86.2	-19.2	-91.7	-86.7	-25.3	-93.9	-84.8	-21.3	-92.1	-85.8	-16.4	-91.4
Gasoline	4.1	-7.7	0.0	4.7	-2.3	0.0	-32.3	-21.6	0.0	-29.2	-29.5	0.0	-26.6	-25.0	0.0	-28.1	-19.3	0.0
Gas oil	4.2	-8.4	0.0	4.0	-2.5	0.0	-85.0	-24.7	0.0	-87 4	-33.2	0.0	-90.8	-28.4	0.0	-91.9	-22 3	0.0
Liquid gas	13.7	-3.1	0.0	11.4	-0.7	0.0	19.2	-4.0	0.0	25 4	-7.0	0.0	34.1	-4.8	0.0	31.6	-2.1	0.0
Other materials and chemical products	-13.1	-1.0	-31.6	-16.1	-2.1	-17.1	-63.2	9.5	-88.5	-69.7	5.9	-92.8	-62.8	9 5	-90.1	-66.5	9.5	-88.5
Basic metal and steel products	-8.9	-3.2	-23.5	-16.5	-3.8	-13.3	-38.6	-5.2	-70.4	-46.6	-7.6	-81.0	-44.4	-6.7	-76.0	-48.9	-7.0	-71.2
Copper, aluminum, and other basic products	-19.0	-0.2	-37.9	-18.9	-0.3	-24.3	-36.8	-1 0	-73.2	-45.5	-2.2	-83.6	-44.4	-0.8	-80.1	-46.2	-0.9	-75.0
Metal products	-2.1	-2.5	-19.4	-2.1	-3.5	0.8	-13.1	-4.8	-58.6	-18.5	-7.4	-71.0	-12.3	-6.3	-62.6	-13 4	-7.0	-51.2
Industrial machinery	547.2	-3.6	451.1	489.3	-5.0	536.0	15.8	-5.9	-42.9	255.4	-7.7	27.1	349.2	-8.3	104.0	315.4	-9 4	152.8
Radio and TV equipment	-14.4	-4.9	-24.1	-22.1	-6.8	-10.8	-27.9	-9.4	-60.2	-40.0	-12.2	-75.0	-36 1	-11.4	-67.8	-40 5	-12.7	-59.5
Motor vehicles	-24.0	-3.3	-36.0	-32.3	-3.6	-30.0	-30.2	-4.7	-66.8	-39.1	-7.3	-78.4	-49.0	-6.7	-78 0	-53.8	-6 9	-74.1
Other industrial products	-11.7	-4.6	-22.4	-18.8	-6.1	-9.2	-25.0	-9 2	-58.8	-35.3	-12.5	-72.8	-33.0	-11.3	-66.4	-37 4	-12.3	-58.0
Electricity	3 0	-0.3	0.0	2.3	0.7	0.0	-3.1	28.1	0.0	-1.9	27.2	0.0	2.2	29.2	0.0	1.1	31.7	0.0
Water	8 6	0.7	-18.8	8.6	0.6	-1.3	11.2	5.9	-61.5	15.6	5.6	-72.4	23.5	4.3	-61.9	23.0	4 0	-50.5
Natural gas	-6.3	-1.9	-24.2	-0.5	-0.4	-6.7	-21.8	0.9	-68.8	-22.8	-1.0	-77.6	-17.7	0.9	-71 9	-16.8	2 8	-65.3
Construction	0.4	-2 0	0.0	0.3	-1.8	0.0	0.8	-0.9	0.0	0.8	-2.5	0.0	1 3	-1.7	0.0	1.2	-1.2	0.0
Trade	0.6	-2.1	-18.1	1.3	-0.5	-5.0	3.4	-3.2	-53.1	4.6	-4.1	-66.6	7.9	-3.0	-58.6	7.6	-1.5	-49.0
Restaurants	1.2	3.2	-29.7	-1.3	3.9	-18.5	1.5	0.6	-59 0	-4.8	2.7	-75.3	6.7	4.7	-67.5	4.2	5.0	-59.3
Hotel and motels	-0.8	1.8	-28.2	-2.3	2.6	-16.2	-17.4	0.5	-66.6	-28.3	1.7	-80.8	-8.3	3.0	-70.6	-11 1	3.4	-63.5
Load transport	9.3	-2.3	-10.4	8.5	-1.1	3.7	7.6	5.4	-62.2	13.1	-0.3	-67.9	26.4	-2.2	-52.7	24.7	-0.8	-42.1
Passenger transport	8.2	-1.8	-12.9	4.9	-0.6	-1 2	4.0	1.8	-59.5	4.3	-1.3	-69.4	17.1	-1 8	-56.7	13.6	-0.7	-47.5
Post and telecommunications	4.4	0.6	0.0	4.4	1.0	0.0	13.1	2.8	0.0	14.0	4.8	0.0	19.3	5.4	0.0	19.2	5.6	0.0
Transport and storage	2 8	-0.7	-19.8	2.8	-0.1	-4.6	-24.5	6.3	-74.2	-23.8	5 1	-81.5	-21.3	5.2	-76.3	-22.5	6.2	-70.7
Other services	5.2	-1.3	-16.6	4.7	-0.3	-2.1	12.6	-1.8	-51.1	13.9	-1.5	-66.5	18.8	-0.7	-57 6	18.2	0.1	-46.7

Source: Authors' estimates.

Appendix

To calibrate our model, we have constructed a database that represents a benchmark equilibrium. This appendix documents the sources of the data and describes how the different data pieces have been combined.

We use four main data sources to construct the database: (1) an Input-Output (IO) table for Iran from 1995; (2) a household expenditure survey (HES) of Iran from 1999/2000; (3) policy data, including tariffs, subsidies to imports and to energy products and tariff equivalence of non-tariff barriers from various Iranian Ministries and agencies including the Central Bank, the Ministry of Industry, the Ministry of Commerce, Ministry of Oil and the Customs Department; and (4) estimates of Iranian elasticities (where available). We combine the data into a Social Accounting Matrix (SAM) that constitutes the basis for our modeling effort.

The IO table provides data on the costs of intermediate inputs and value added (labor and capital) in 43 production sectors and it distinguishes household demand, government demand, investment demand, export demand and import supply by sector. The household demand is divided in two categories: urban household demand and rural household demand. To further disaggregate the households, we use the HES to decompose both rural and urban households into10 household types, where households are grouped according to income. That is, all Iranian households have been grouped into one of the 20 household types depending on their income level and whether they are rural or urban.

Unfortunately, the IO table and the HES are not consistent with respect to total rural and total urban household demand by sector. We therefore use share data from the HES to decompose the IO table's data on rural and urban household demand. That is, for each sector and for both rural and urban households, we calculate each of the 10 household types' share in total household demand by sector in the HES, and then apply these shares in the IO table. We then have a table with the 20 households' expenditure on output from the 43 production sectors.

Neither the IO table nor the HES provide data on the income pattern by household type. We therefore have no information on the distribution of income across factors of production nor on the sector in which the income comes from. We therefore make the strong assumption that all households have identical income patterns.

The IO table also has little information on the policies we want to analyze and the data that it does contain – collected import tariff revenues – do not represent current policies given the delay in the publication of the IO table. We have therefore relied on Iranian ministries for our dataset on policy parameters for barriers to imports (tariffs and non-tariff barriers), foreign exchange subsidies, and subsidies to domestic petroleum consumption.

The data on barriers to imports and on foreign exchange subsidies are described in detail section 2 of the main text. The IO table reports the costs of imports to the user of the imports, so in constructing the SAM, we incorporated the data on the barriers to imports by deducting the costs of the barriers to arrive at the border costs of the imports. In the case of foreign exchange

subsidies, we derive the border costs of the imports by adding the value of the foreign exchange subsidy to user costs of imports to arrive at the border costs.

The data on energy subsidies were presented in table 0. Since the petroleum subsidies apply to domestic consumption they effectively apply to both imports and domestic production. In the case of imports, we add the subsidy to the user costs of imports to get the border costs of the petroleum imports. In the case of domestic production, we add the subsidy to the costs of production.

Our database also includes a set of elasticities. Many sources were used for the elasticities. We employed the study of Ahangarani (1999) who estimated a system of demand functions for Iran. We also employed the study by Hope and Singh (1995) for energy elasticities. These studies suggest that the price elasticities of demand for different energy goods are between –0.2 and –1. We employed –0.4. In a CES function with a small energy cost share this implies an elasticity of substitution of 0.4.

These studies suggest income and price elasticities of household goods of about 1 and –1, respectively. This corresponds to a Cobb-Douglas utility function. Some essential household goods are reported to have price elasticities less than unity. We choose –0.4 for these goods.

In most economies, the capital-value share in total value-added is constant in the long run, which is consistent with a Cobb-Douglas production function for total value added.

Most studies suggest low substitutability between most intermediate inputs in different product categories, corresponding to the Leontief production function for the aggregate of intermediate goods (see, for example, de Melo and Tarr, 1992). Finally, most studies suggest energy demand elasticities in production between -0.2 and -0.7 - we chose an average value of -0.5 (see, for example, Hope and Singh, 1995).

In the remaining cases, we use estimates employed in similar analyses, such as de Melo and Tarr (1992); Harrison, Rutherford, and Tarr (1993); and Rutherford, Rutström, and Tarr (1997). In particular, we choose a value of three for the elasticity of substitution between domestic and foreign varieties in demand. For energy goods, which are relatively homogeneous, we choose a value of six. Figures 5.1 and 5.2 show the nesting structure of the production functions and the utility functions along with the assumed elasticities of substitution.

Figure 1: Production and Allocation of Output

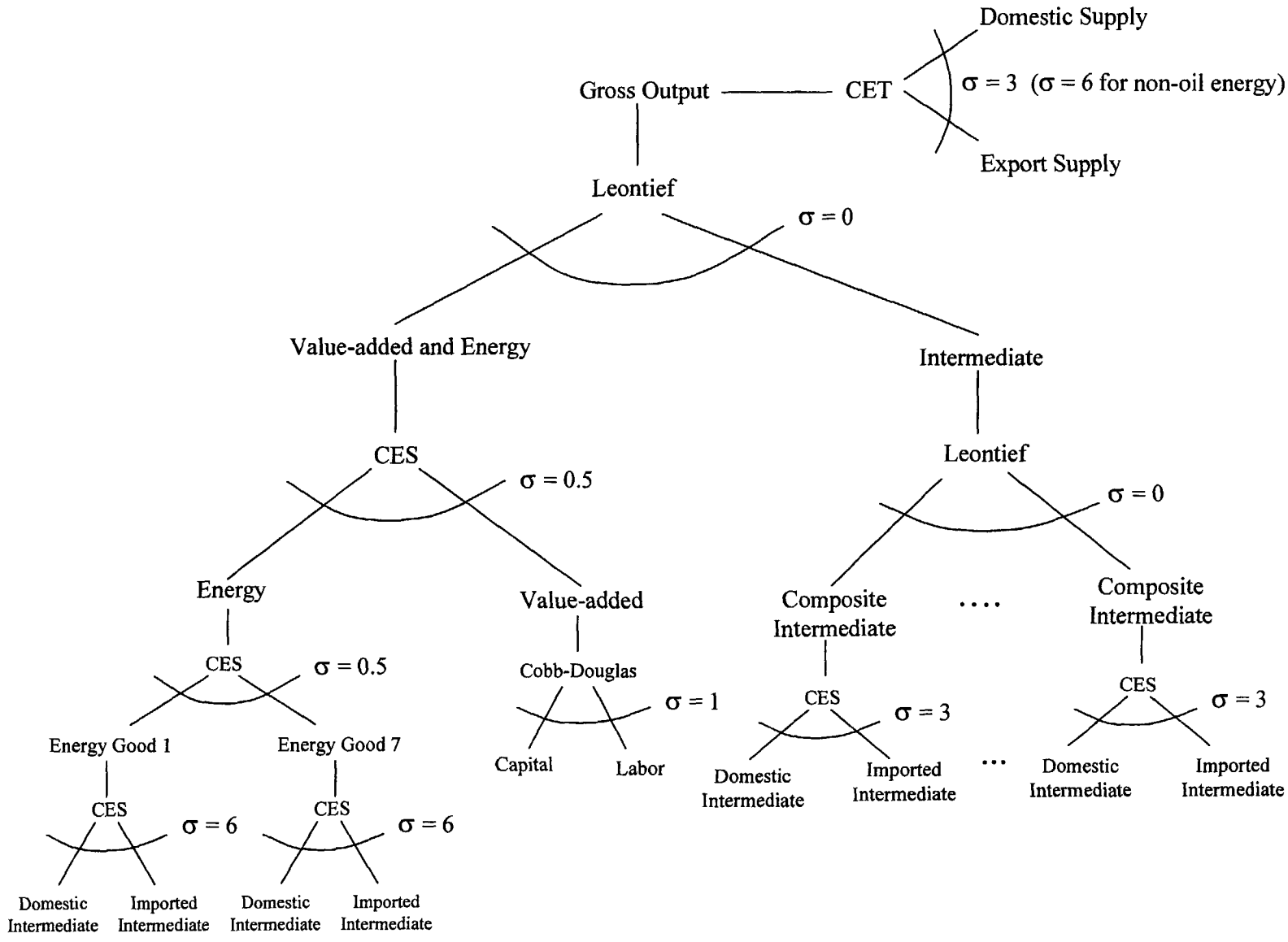
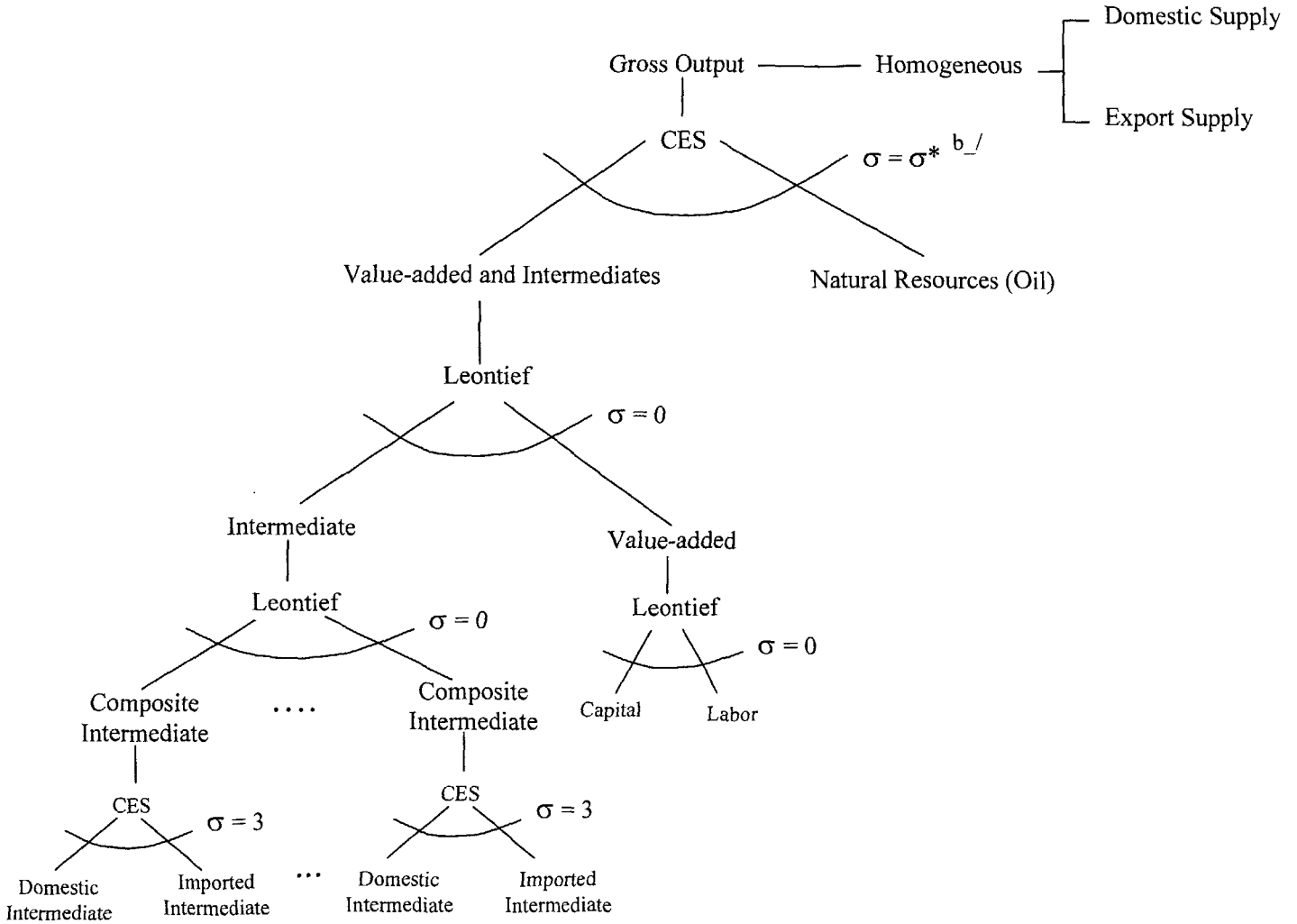
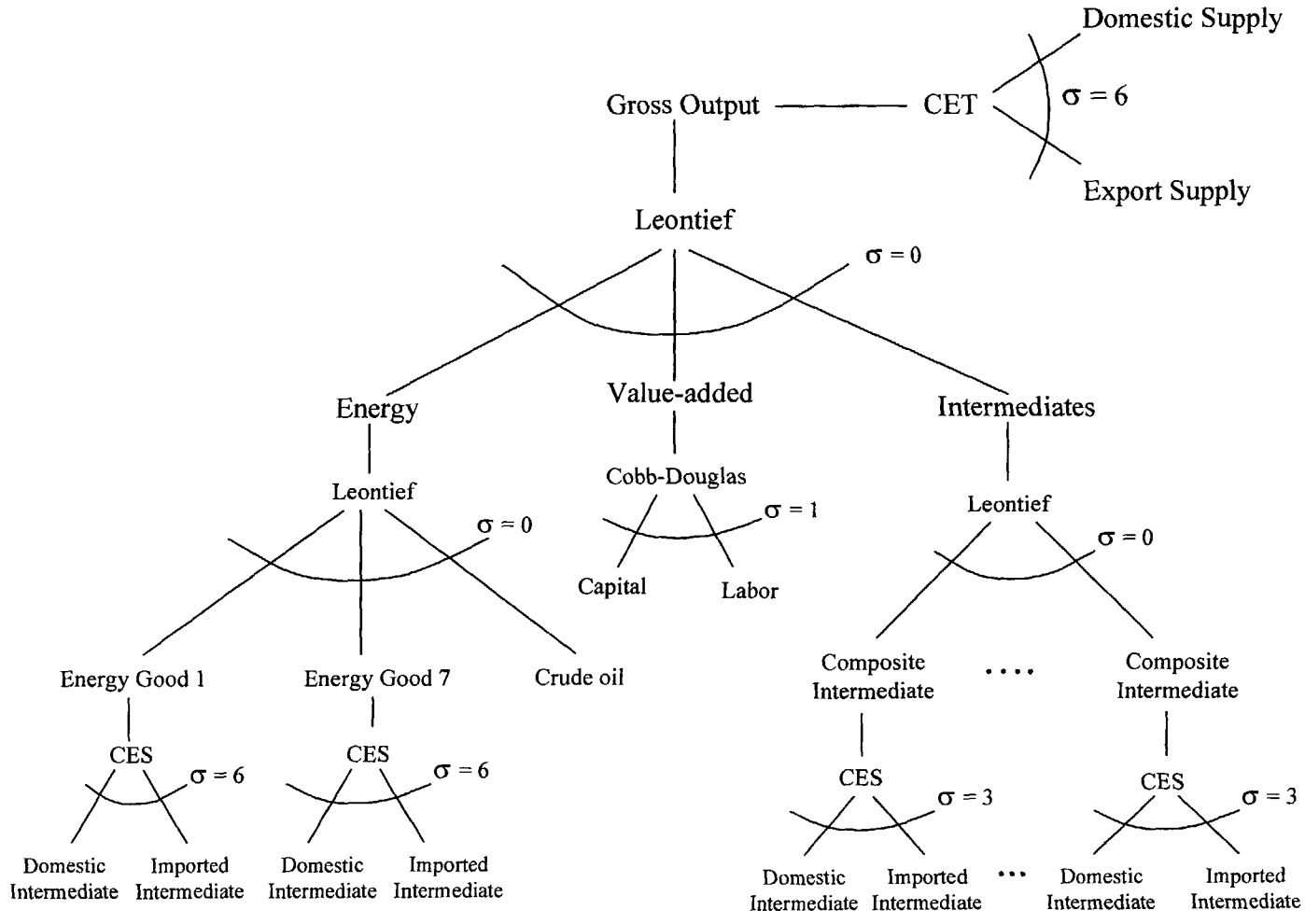


Figure 2: Crude Oil Production[a_/] and Allocation



a_/ The farming and livestock sectors share the same production structure, but their exports and domestic outputs are differentiated.
b_/ σ* is calibrated such that elasticity of supply equals 0.5.

Figure 3: Energy Sectors [a/]



[a/] Energy sectors are gasoline, kerosene, fuel oil, liquid gas, natural gas, gas oil and electricity.

Figure 4: Consumer Demand

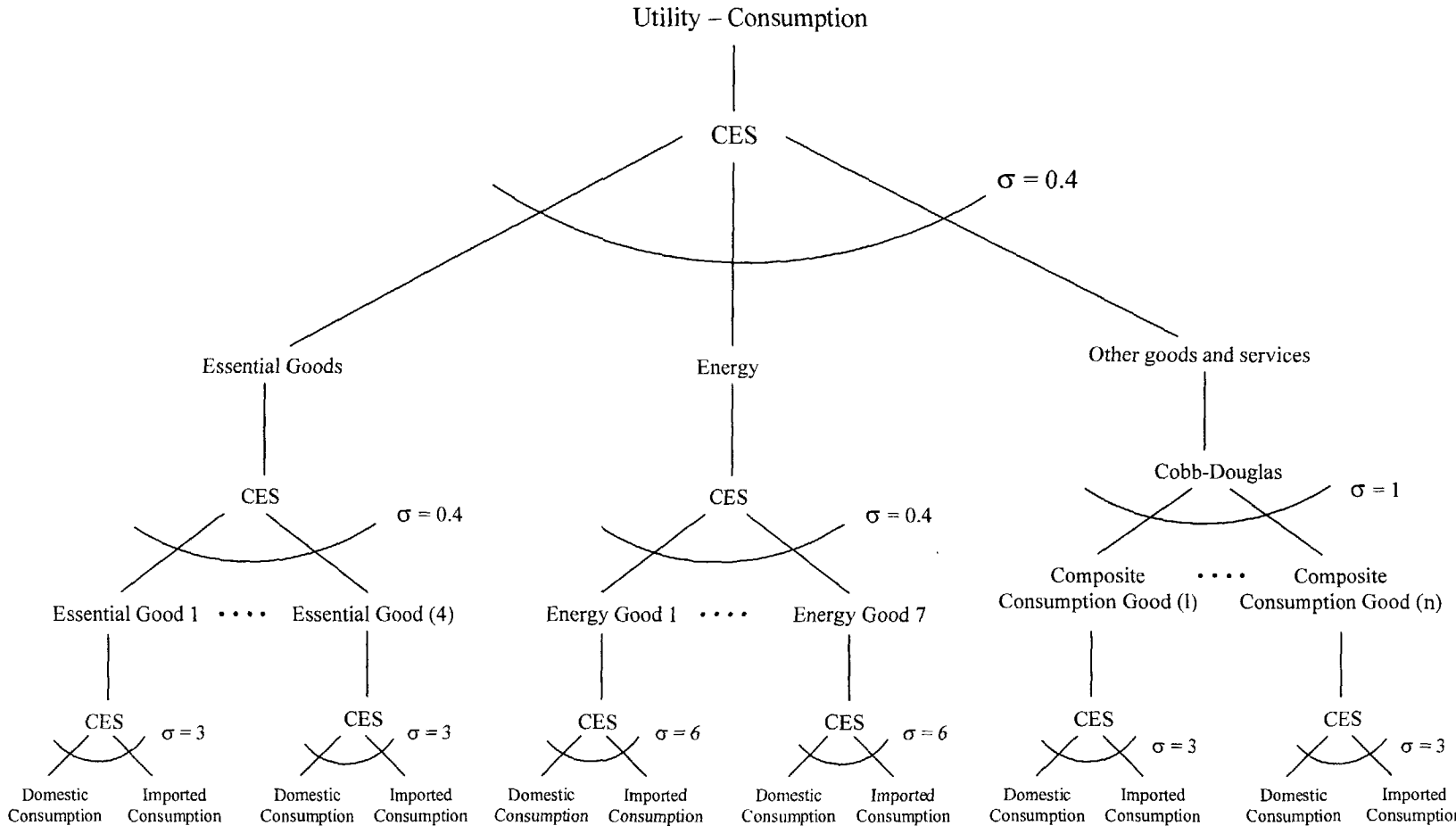
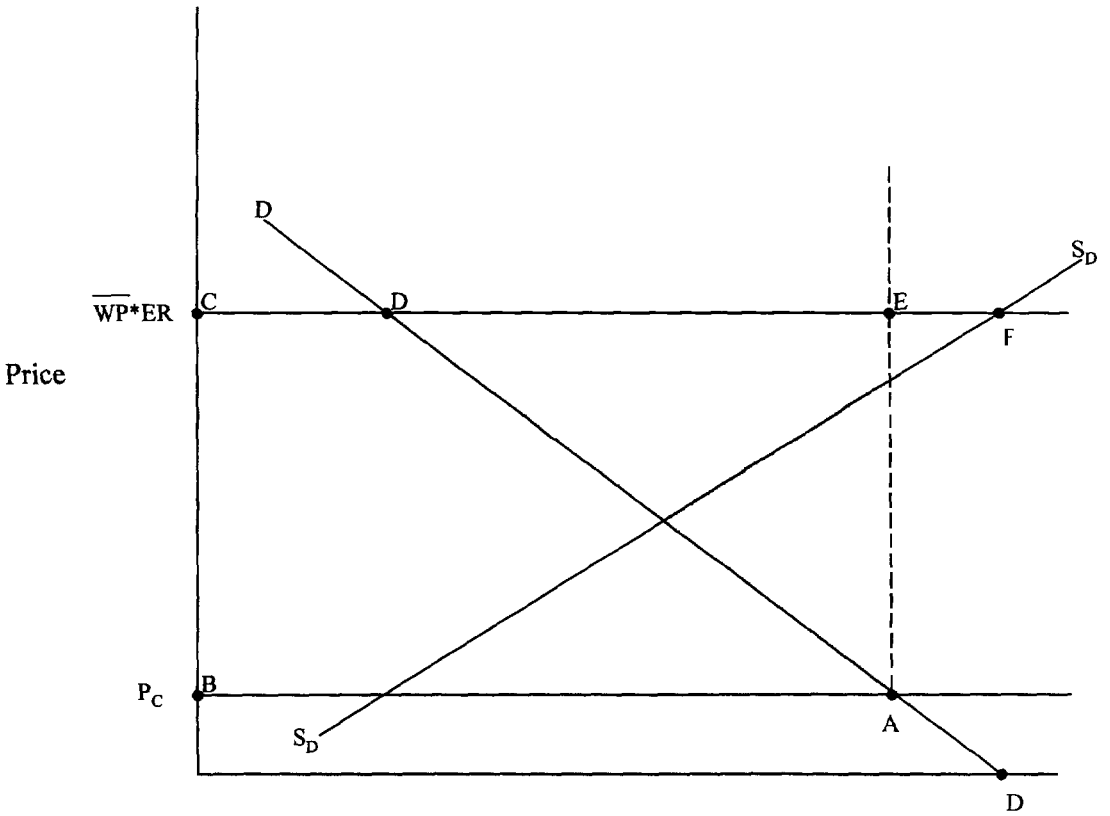
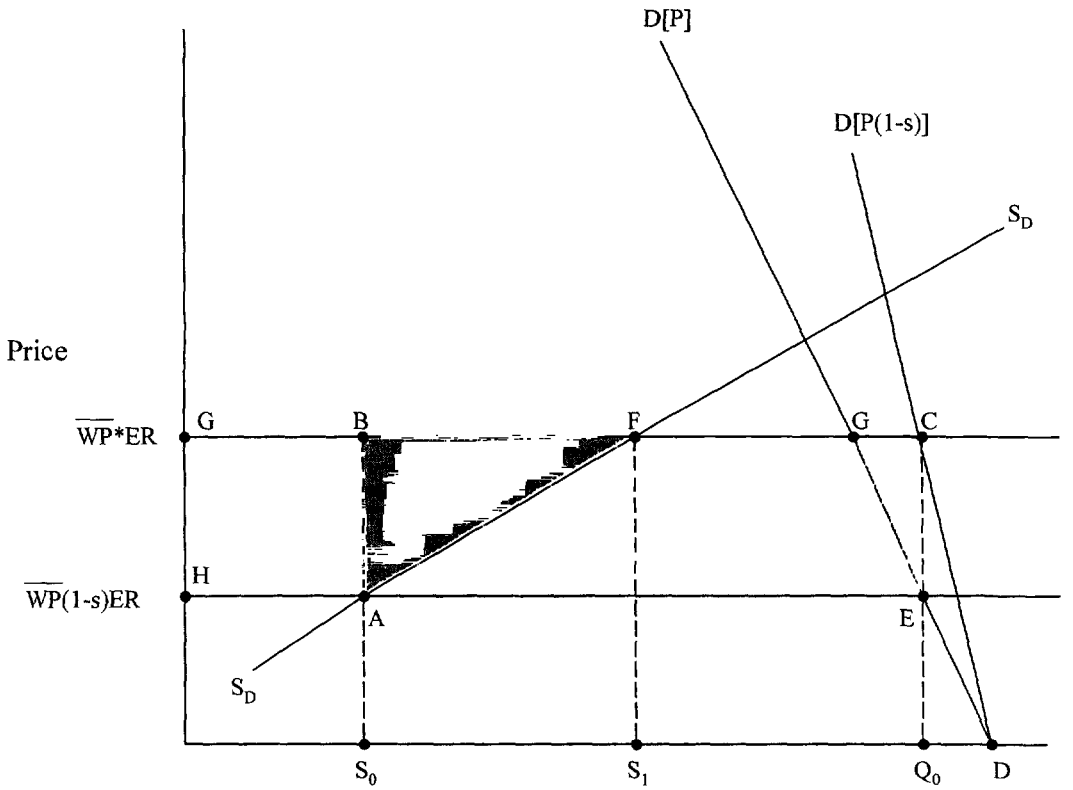


Figure 5: Market for Energy Projects, with Endogenous Consumption Subsidy



Energy product prices are initially subsidized by the government such that the price to domestic consumers is fixed at P_c. WP is the fixed world price and ER is the real exchange rate, so WP*ER is price domestic firms receive for exports. With S_d as the domestic supply curve, domestic firms produce the quantity CF. Domestic consumers consume CE and domestic firms export EF. **Deadweight loss is the shaded area ADE and the government subsidy is the area ABCE.** The height of the government subsidy, AE is endogenous, and depends, among other things, on the world price and the real exchange rate.

Figure 6: Import versus Consumption Subsidies for Essential Commodities



Import subsidy: Initially essential commodity import prices are subsidized at the ad valorem rate s, so imports are supplied at WP (1-s) ER where WP is the world price, s the subsidy rate and ER the real exchange rate. With S_d as the domestic supply curve, S_0 is the quantity supplied domestically and Q_0 is the quantity demanded, with imports as the difference. **Deadweight losses are the sum of production and consumption deadweight losses = ABF+GCE. Government subsidy = ABCE.**

Consumption subsidy: The subsidy ridden demand curve is depicted as a shift to the right relative to the undistorted demand curve. The import subsidy is removed, but the government provides a subsidy to consumers such that the domestic price paid by consumers does not change in equilibrium. Q_0 is demanded by consumers, S_1 is supplied by domestic firms and imports are the difference. **Deadweight losses are reduced relative to import subsidies to the consumption deadweight losses GCE; but the government subsidy increases to HGCE.**

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